AUGUST 1954

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
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Another CAST-MASTER BONUS feature

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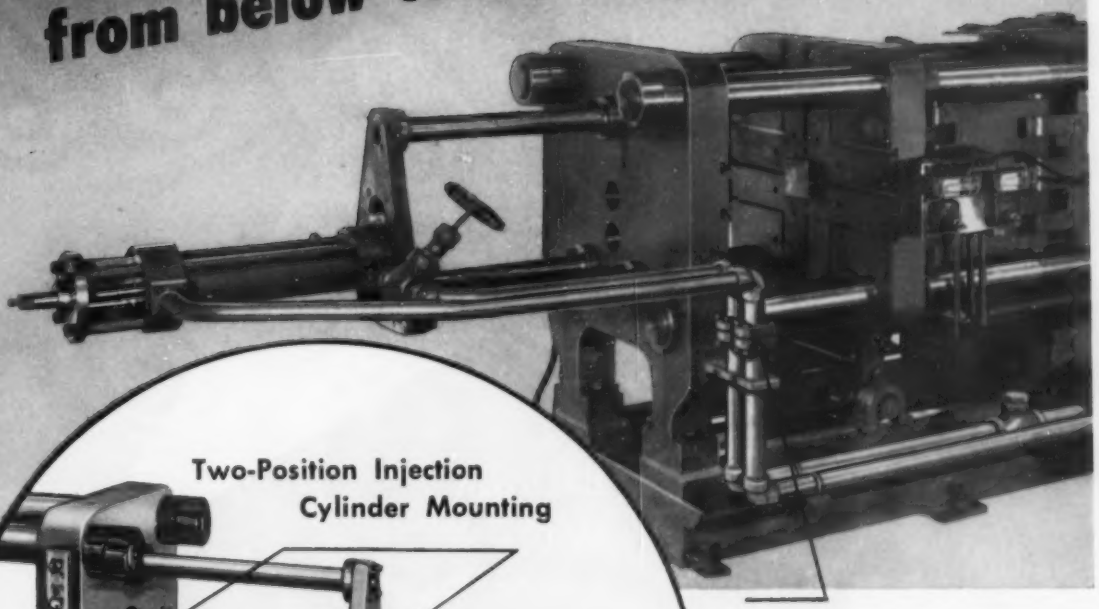
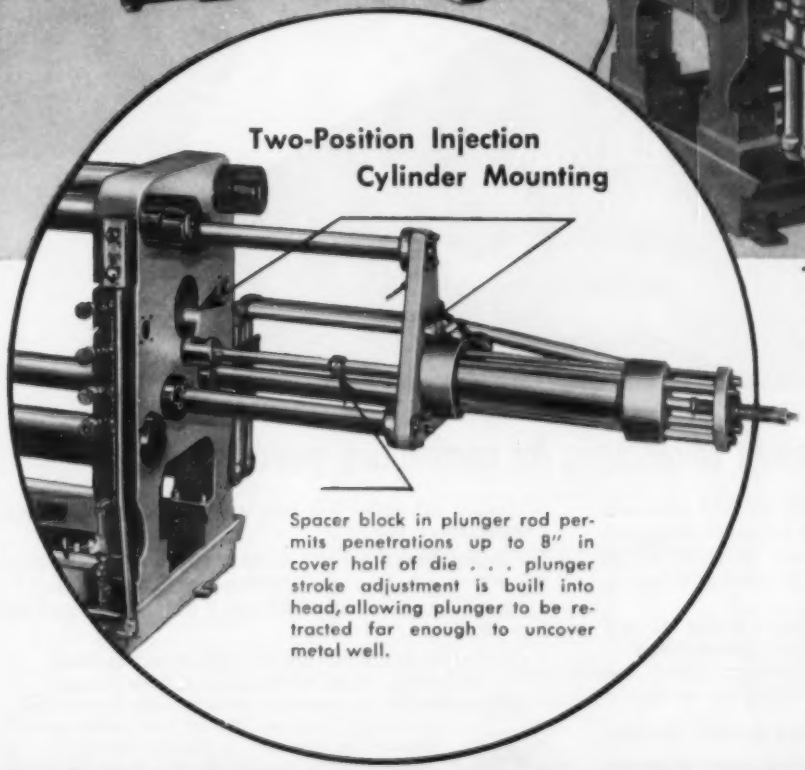
from below center to center shot!



When changing from below center to center shot, simple addition of extra section of pipe eliminates the use of hose or flexible tubing, thereby affording an extra measure of safety.

Two-Position Injection Cylinder Mounting



Spacer block in plunger rod permits penetrations up to 8" in cover half of die . . . plunger stroke adjustment is built into head, allowing plunger to be retracted far enough to uncover metal well.

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Only the Baldwin Model "C" Compacting Press can solve every *pressing* problem for the powdered metals industry. To learn how it can work for *you* send for the new booklet specially prepared to give you a detailed description and specifications of the Model "C." Write to Department 4656, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

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AUGUST, 1954
Volume 12 Number 8

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • PLASTER MOLD CASTINGS
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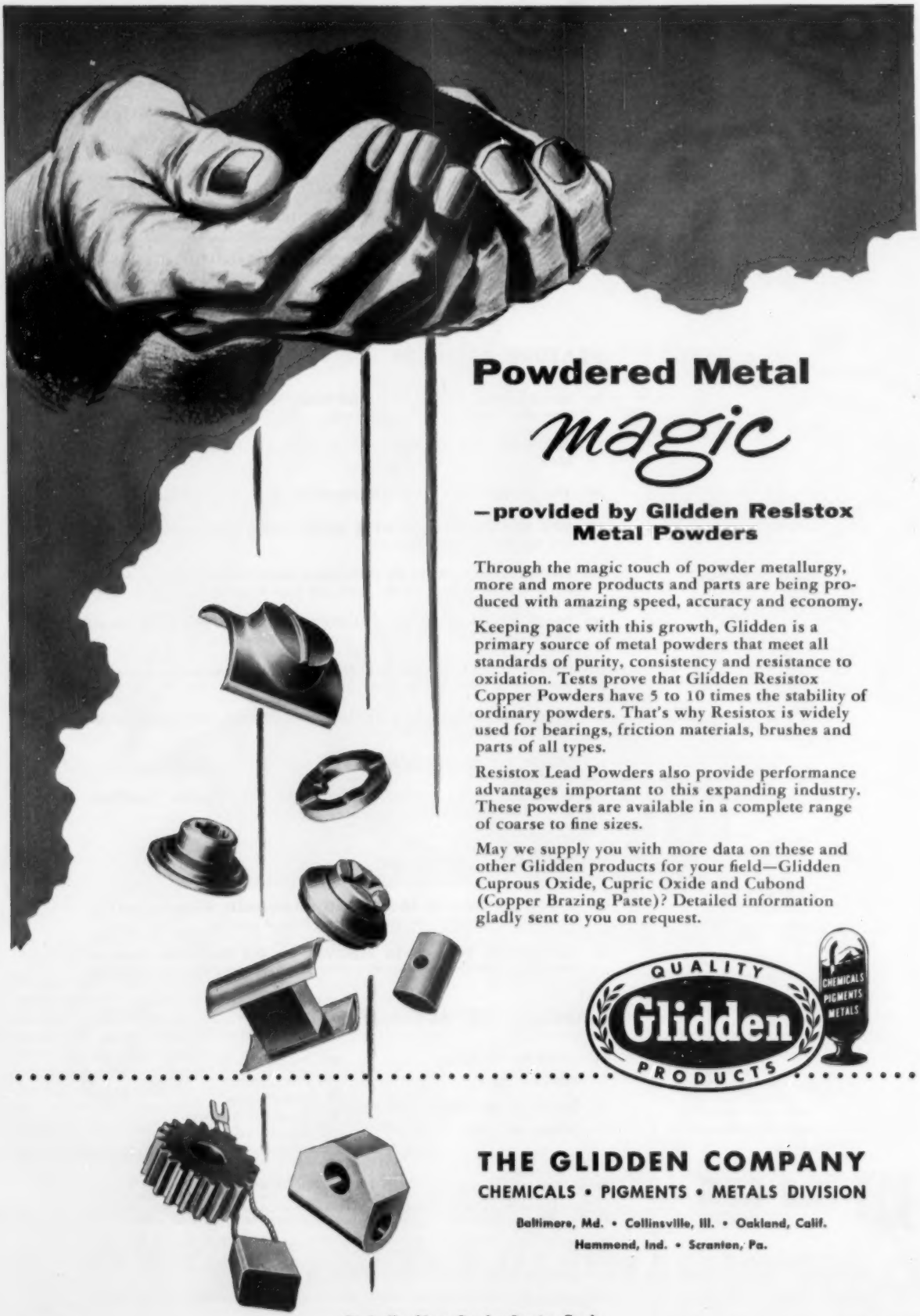

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LETTERS TO THE EDITOR

DIE CAST CUTLERY?

The National Bureau of Standards advised us to communicate with you in hope of mutual assistance.

We are inquiring into the possibility of a white metal alloy that would be suitable for die casting table flat ware, as spoons and forks.

The advantages of such development are quite obvious, when we consider the high percentage of waste in stamping, also the fact that stainless steel is a vital defense material and should not be wasted on table flat ware.

Aluminum, Nickel and Silver alloy would be the answer. Is there such an alloy on the market? If not, why not?—F. R. G. (Secretary).

True, the economics of die casting simple shapes such as forks and spoons might compare favorably with stamping them from stainless steel, especially if multiple cavity die casting dies were used.

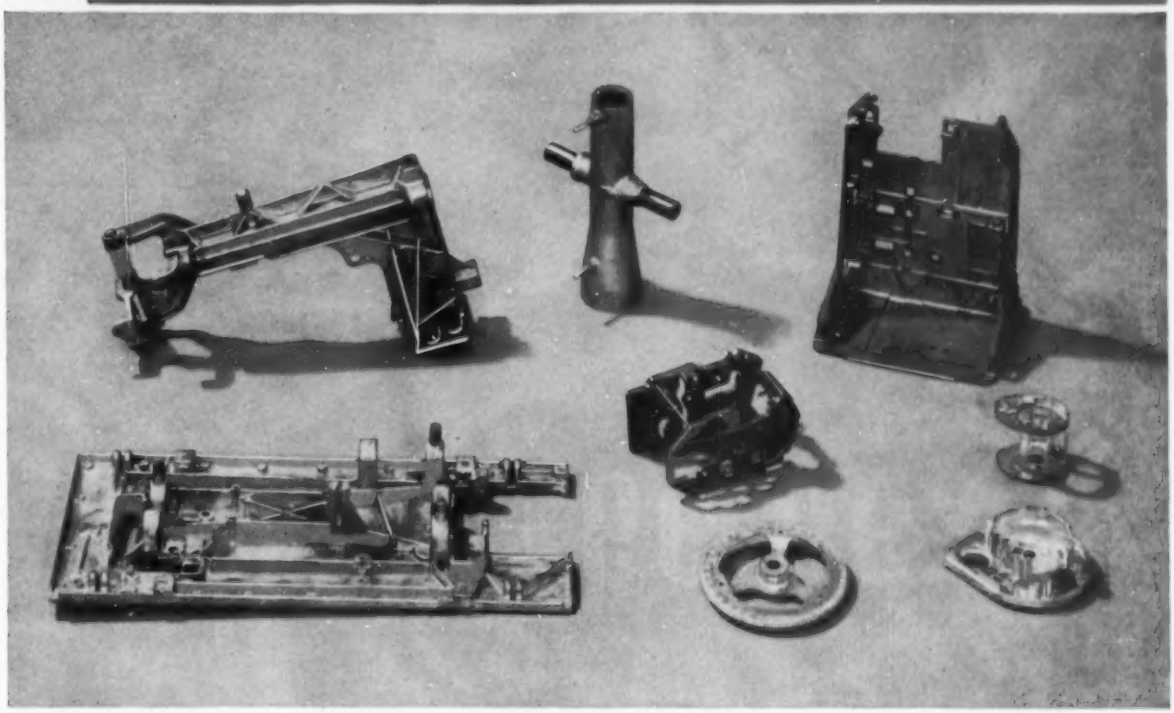
But, the big problem of die cast cutlery appears to be functional, due to available die castable alloys: 1) It is doubtful that any of the commonly die cast aluminum alloys have the required physical properties for fork tines; 2) Abrasion encountered in service would indicate need for plating or anodizing for protection, which would add to cost; 3) Thermal conductivity of aluminum might not be desirable.

No such die casting alloy as you describe is available, but if it were available and die castable, the use of nickel would be just as undesirable (being vital to defense) as though a nickel-bearing stainless steel were employed.

There are aluminum die cast-

Continued on page 10

You can CUT COSTS *with* PRECISION DIE CASTINGS



COMBINE PARTS IN ONE DIE CASTING

Substantial savings in production costs can often be realized by combining several parts into one Precision die casting. Precision's ability to produce die castings using intricate dies and coring methods offers you almost unlimited possibilities in savings.

You benefit two ways — the cost of producing one die casting is usually less than the sum of several of its parts in smaller castings. Secondly, you eliminate the assembly costs involved in putting together the smaller parts.

We'd be glad to discuss your problems with you and show you how you can cut costs.

Write for complete information TODAY!

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212 Walnut St., Fayetteville, N. Y.
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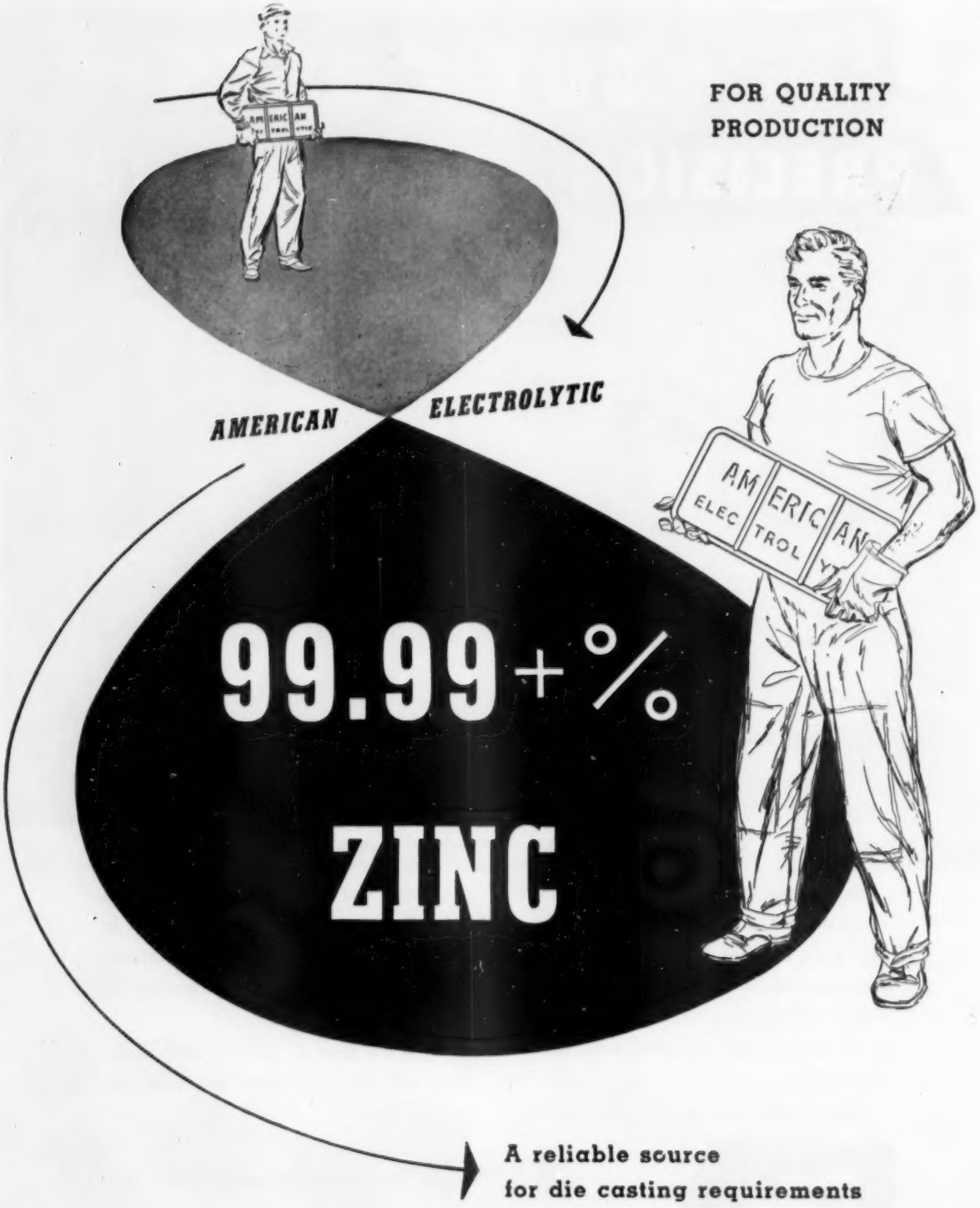

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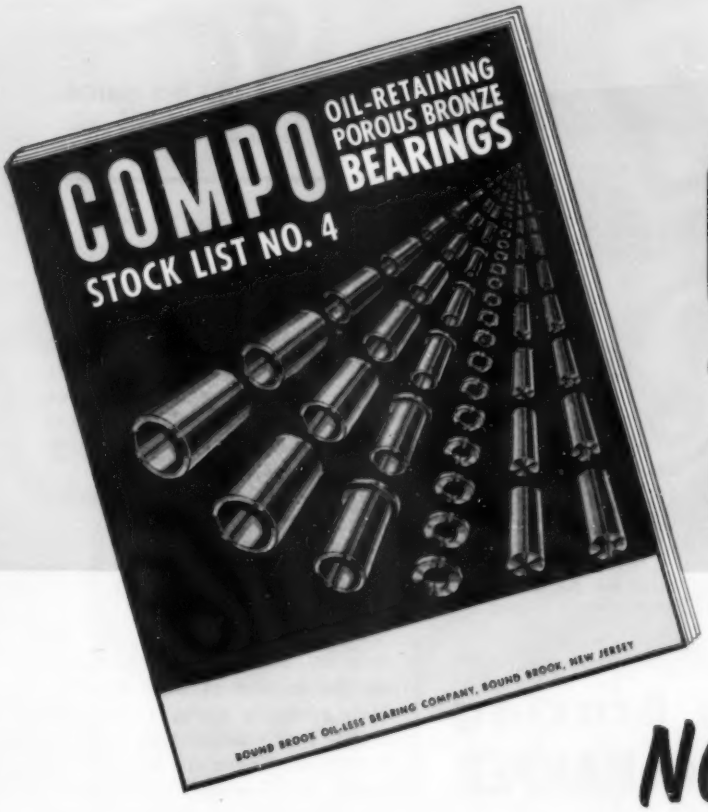

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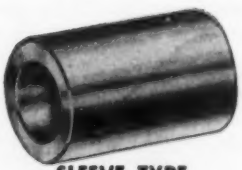
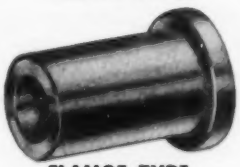
OIL-RETAINING POROUS BRONZE

BEARING

STOCK LIST NOW AVAILABLE

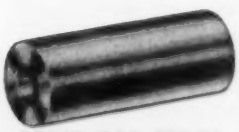


SLEEVE TYPE



FLANGE TYPE

BAR STOCK



CORED BAR STOCK

WASHERS

If you play a part in the design, production or maintenance of equipment using sintered bronze bearings, or if the job of purchasing bearings falls within your domain, you'll find a wealth of useful information within the 20 pages of the new Compo Oil-Retaining Porous Bronze Bearing Stock List No. 4. Bound Brook has compiled an easy-to-read list of the most popular stock sizes of bearings which are available for immediate shipment. In addition the Compo Stock List Brings you up-to-the-minute data on bearing application, installation, lubrication and machining. And here's another thought! When requesting your copy of the Compo Stock List why not have us send one to your supplier of bearing-using components or equipment? It may enable him to make savings beneficial to you both.

Write for a list of location of local warehouse stocks.

4

BOUND BROOK

BOUND BROOK OIL-LESS BEARING CO., EST. 1883, BOUND BROOK, N. J.

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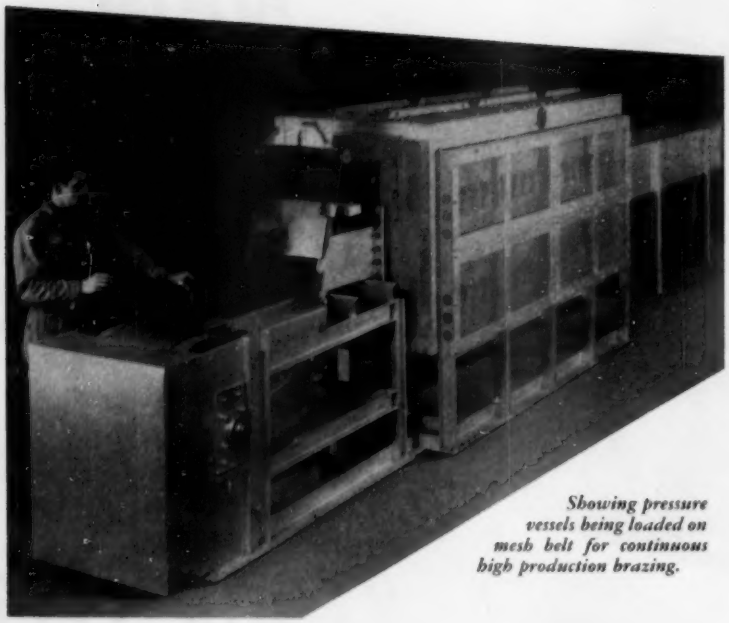
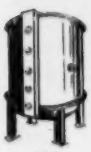
POWDER METALLURGY BEARINGS & PARTS



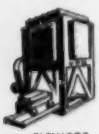
Showing pressure vessels being loaded on mesh belt for continuous high production brazing.

High Production Brazing Problem solved with HARPER Mesh Belt *Electric Furnace*

BOX



BELL



ELEVATOR

STRAND ANNEALING

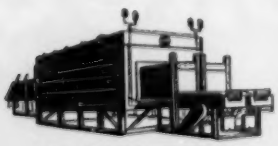
Harper Continuous Mesh Belt Conveyor Furnace shown above is another example of how manufacturers are cutting costs and increasing sales.

Operator is loading pressure vessels such as used for insect bombs, "do-it-yourself" paint sprayers and blow torches.

Accurately controlled heating zone together with high power input makes it possible to handle volume production. Continuous Mesh Belt cuts costly handling time. Uniform temperature gives you uniform high quality.

There is a size and type of Harper Electric Furnace to fit your requirements. Write for information.

Furnace Builders *for over 30 Years*



TWIN AND SINGLE MUFFLE PUSHER

HARPER
Electric Furnace Corp.
41 RIVER ST., BUFFALO 2, N. Y.

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LETTERS TO THE EDITOR

continued from page 6

ing alloys which have a suitable white color and which can be buffed or barrel finished to a high lustre. If these alloys could meet the physical requirements, or if the design of forks and spoons could be adjusted to permit the use of these alloys, then your project might be more practical.—Ed.

HIGH DENSITY — HIGH STRENGTH

I just finished reading the article by Mr. Edward N. Mazza on the subject of high density-high strength parts. I find the article quite interesting and informative. There are a couple of points that I would like to have straightened out in my own mind:

I believe that there is something missing at the top of Page 44. I presume that all the items were sintered at 1120° C for one hour, as explained on Page 42.

I would like a little explanation on Table No. 5. I am assuming that the changes represent inches per linear inch. Is that correct? I am also assuming that the growth or shrinkage represents the difference between the actual die diameter and the measurement of the piece after final sintering. Am I correct in my assumption?

I mentioned Table 5 because quite often I have noticed that when a piece is coined at fifty or seventy tons per square inch, it grows considerably above the actual diameter of the die itself. But, in the case of pure iron and without pre-sintering, the dimensions come down below the die dimensions.

Please pass along to Mr. Mazza my appreciation for his work and helpful data to the sintered metal field. I do feel that a few graphs would be more helpful than the tables, but anyone can

Continued on page 88

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for every die casting need!

hotform

The famous original 5.00% chromium steel, known and used by die casters everywhere for aluminum and white-metals casting. No movement in hardening — no surface pitting — good machining qualities . . . matchless advantages for your jobs!

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Most of these parts were purchased by leading manufacturers . . . experts at getting the "best buy". Do you see one that resembles a part you use now, or need? If you do, why not check with us for possible savings? Send prints or samples for estimates and engineering advice, at no obligation. Or, write for our General Facilities and/or Small Parts Bulletins.

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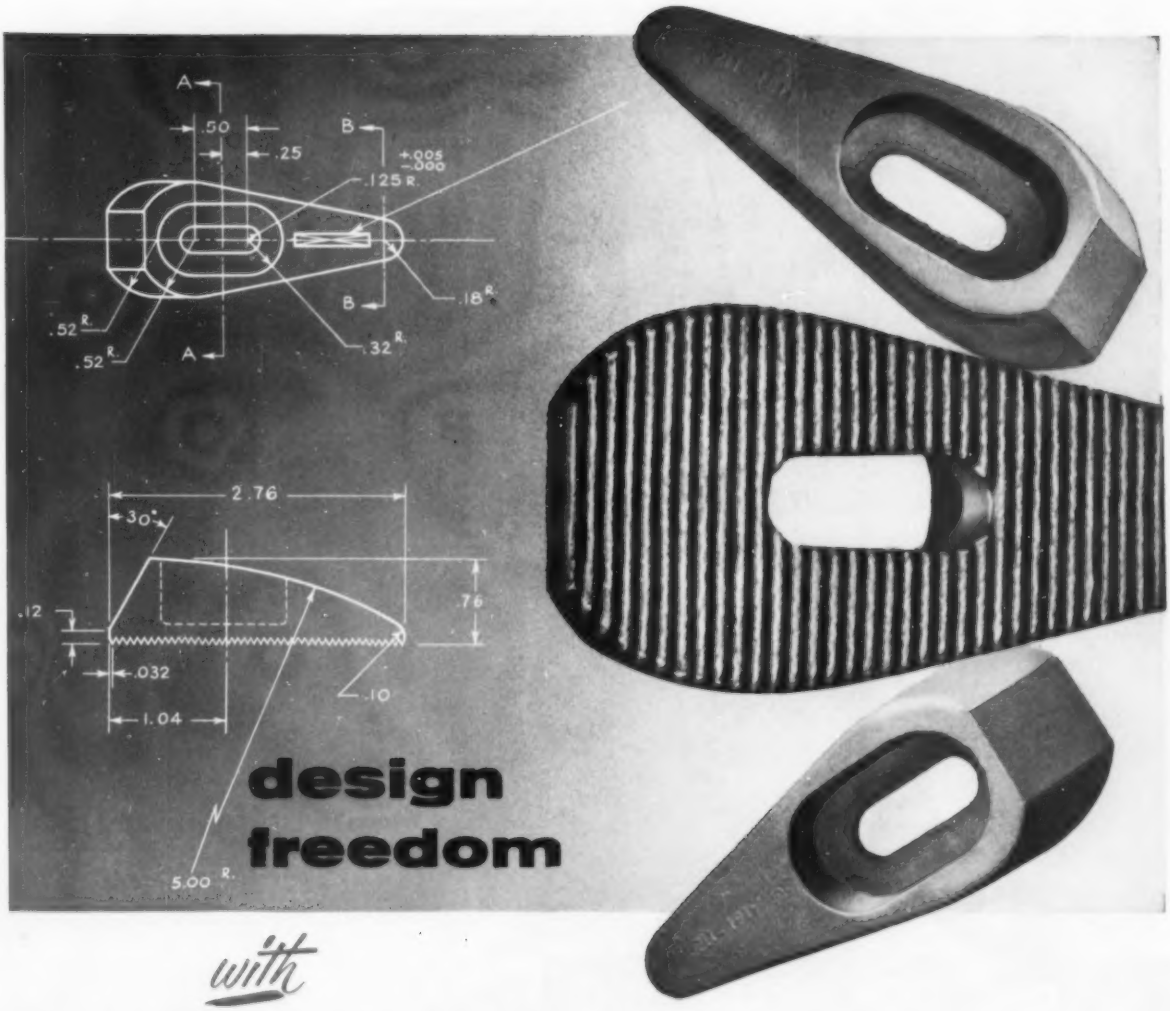

with

CRUCIBLE ACCUMET PRECISION INVESTMENT CASTINGS...

Here's another good example of how Accumet Precision Investment Castings help put an end to design problems.

To machine the curved and tapered surfaces, elongated hole and counterbore, and serrations on this AISI 4140 alloy steel aircraft part, would have been too costly to be practical. But the parts were quickly and economically produced by investment casting.

More and more parts are being *designed* specifically for the investment casting process. And there are good reasons why. Crucible Accumet Precision Castings allow the greatest freedom of design. Intricately shaped parts can be made of any grade of steel, including high-alloys, in large quantities and at low cost.

It will pay you to let your local Crucible representative give you the whole story of how Accumet Precision Castings can help you produce a better product at lower cost.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ACCUMET PRECISION CASTINGS**

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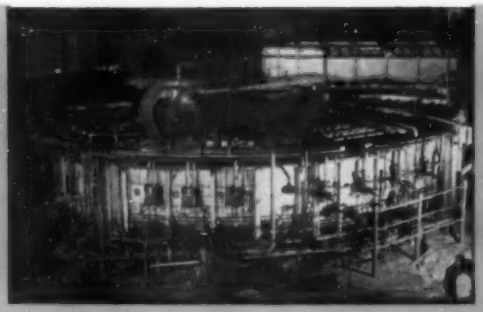


One line break with flammable fluid, causing a costly shutdown, moved Spang-Chalfant to switch to Monsanto Pydraul. Long-lasting and noncorrosive, Pydraul reduces make-up rates by as much as 80%.

Steel fingers, powered by 800 gallons of fire-resistant Pydraul, pick up white-hot billets as though they were cigarettes, moving them in and out of the 2250° F. heat. This loading operation stops only once a week.

PYDRAUL STOPS FIRES BEFORE THEY START

Monsanto Hydraulic Fluid Helps Steel Furnace Operate 160 Hours a Week

OPERATING CONTINUOUSLY to keep up with production schedules, this Hagan Rotary furnace at the Spang-Chalfant plant of The National Supply Company is equipped with a hydraulic loading boom actuated by fire-resistant Pydraul F-9.

BEFORE PYDRAUL F-9 was adopted, a line containing flammable fluid broke—shutting the furnace down for six hours. In addition to damage to electrical connections, the downtime was expensive in terms of lost production.

AFTER PYDRAUL WAS INTRODUCED, one incident demonstrated dramatically its fire-resistant properties. A ruptured hose connection sprayed Pydraul over hot billets and into the furnace door. This time, however, there was no damage to equipment or injury to personnel. Only a minimum of production time was lost while the hydraulic system was refilled.

Pydraul: Reg. U. S. Pat. Off.

***Ask us** for this booklet on Pydraul. Write Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478, St. Louis 1, Missouri.*

MONSANTO
CHEMICALS—PLASTICS

Circle No. 50 on Reader Service Card

Reference Data offered in this month's advertisements

1. DIE LUBRICANT — The use of dry film lubricants as die lubes is discussed in bulletin No. 426-D and reprint DC, both available from Acheson Colloids Co.

4. PARTS BY MERCASTING — The uses and advantages of the frozen mercury pattern process of investment casting (Mercasting) are explained in Bulletin No. 706 from Alloy Precision Castings Co.

5. PERMANENT MOLD CASTINGS — Full information about aluminum permanent mold castings is available from Aluminum Casting & Engineering Co.

7. DIE CASTING ALLOYS — Bulletins giving the compositions and physical properties of castable aluminum and zinc base alloys are available from Aluminum Smelting & Refining Co.

8. ALUMINUM ALLOYS — A reprint of an article on the aluminum smelting industry, its history and products can be secured from the Aluminum Smelters Research Institute.

11. ALUMINUM DIE CASTING ALLOY — Technical information on the compositions, properties, etc. of aluminum die castable alloys has been prepared by Apex Smelting Co.

12. PISTON RINGS — A complete listing of the available sizes and types of piston rings for die casting machines, together with a price list can be secured from Auto-Diesel Piston Ring Co.

15. DIE CASTING MACHINES — Engineering data and prices of small die casting machines together with a description of these machines and their capabilities is in bulletin A-10 of the A B C Die Casting Machine Co.

17. POWDER METAL PARTS — Bulletin SM-54 on Bassick powdered metal wheels and other powder metallurgy products is ready for distribution from the Bassick Co.

18. COMPLETE LIST — of more than 600 most widely used sizes of porous bronze bearings are listed in the new edition of Bound Brook "Compo" bearings stock list.

19. COMPACTING PRESSES — Baldwin-Lima-Hamilton has a new booklet available describing their Model C compacting press for metal powders.

20. ALLOYS FOR INVESTMENT CASTING are described and their composition and properties given in bulletins and technical data sheets from Cannon-Muskegon Corp.

21. DIE CASTING MACHINES — for all purposes and in all sizes are described in the complete catalog of Cast-Master, Inc.

23. NONFLAMMABLE FLUIDS — for all types of hydraulic systems are described and their properties given in engineering data from Carbide and Carbon Chemicals Co.

26. BIG OR TINY DIE CASTINGS — are described and the facilities for making them illustrated in the General Facilities and Small Parts Bulletins available from the Dollin Corp.

27. INVESTMENT CASTING — alloys in handy small sizes are described and specifications and prices available from Charles Dreifus Co.

29. METAL POWDERS — Complete data on Glidden Co.'s metal powders, copper oxides and copper brazing paste is now ready.

30. SAMPLE CASTINGS — and a brochure are offered by Gries Reproducer Corp., specialists in manufacturing tiny die castings.

32. HEAT TREATING FURNACES — for brazing, sintering, steel treating and other uses are described in engineering data that can be secured from the Harper Electric Furnace Co.

33. THE HENNING MESSANGER — gives news about metals and alloys, the Henning plant and personnel.

41. HEAT EXCHANGERS — for die casting machines are described in Bulletin 1.1K5 from Kewanee-Ross Corp.

42. HYDRAULIC PUMPS — for individual station installation or central station installation are fully described in literature prepared by Kobe, Inc.

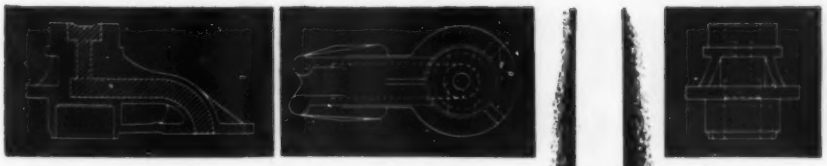
43. MELTING FURNACES — for direct casting of investment castings and similar applications are described and their characteristics given in data from Detroit Electric Furnace Div.

44. FULL LINE — of die casting machines are presented in a catalog from Kux Machine Company giving specs for many sizes and capacities.

45. MAGNESIUM DIE CASTINGS — are described and their advantages detailed in informa-

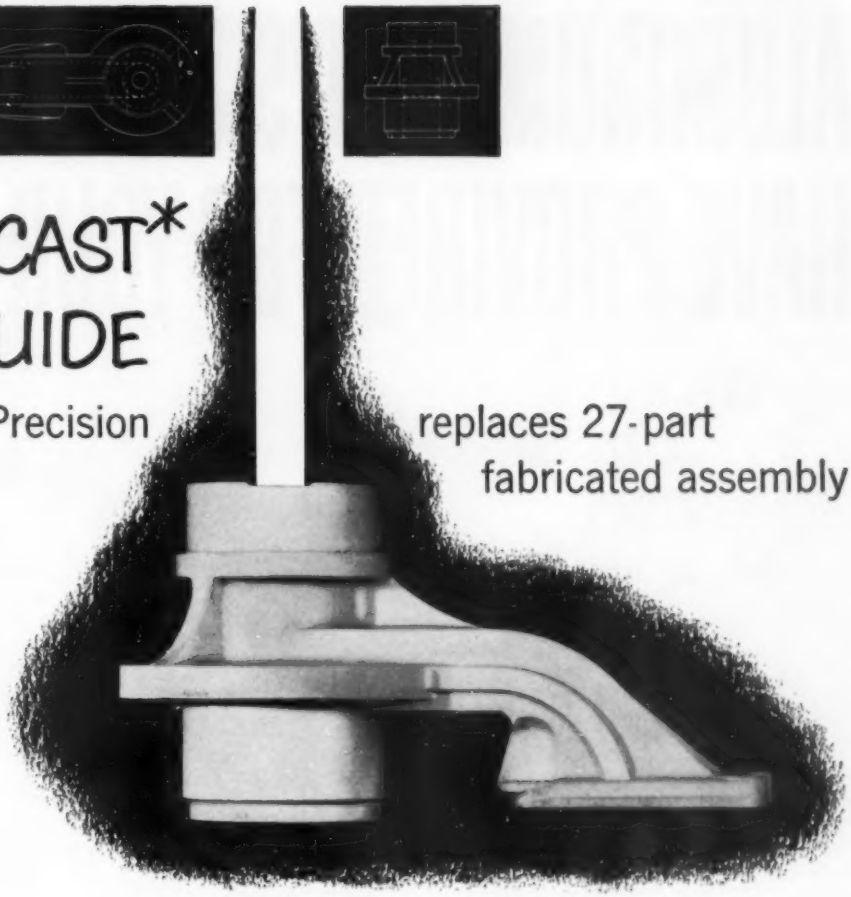
Continued on page 90

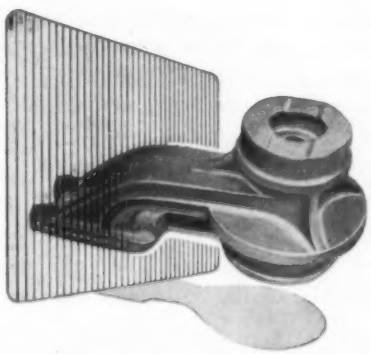
To get copies of any item listed here, simply circle the appropriate number on the Reader Service Card bound into this issue.



ONE MERCAST* WAVEGUIDE

by Alloy Precision replaces 27-part fabricated assembly





3D SLIDE FILM IN FULL COLOR shows how this part was made . . . follows it through complete mercasting process from die to finished part. Write and arrange to have it shown to your designers, engineers, planning and production executives. And request your free copy of Bulletin 706 on mercastings.

Original design of this complicated wave guide called for a fabricated assembly of approximately 27 separate parts. Production operations involved machining to extreme tolerances . . . costly precision jigging . . . brazing . . . tedious silver soldering . . . difficult inspection with an extremely high percentage of rejects.

Seeking an improved manufacturing technique, engineers of a major airborne electronic equipment producer decided mercasting might be the answer. They called Alloy Precision application engineers for consultation. Now this part is mercast—by Alloy Precision—as a single unit in 356-T6 alloy to a tolerance of ±.003 inch/inch. Result is that assembly and most machining operations are eliminated . . . production is up . . . rejects are down . . . costs have plummeted.

Perhaps this typical cost-slashing case history will suggest how mercastings—by Alloy Precision—will whip *your* production and inspection problems. Send us prints of your problem parts. Learn how Alloy Precision can save your time, temper and money. A-8149

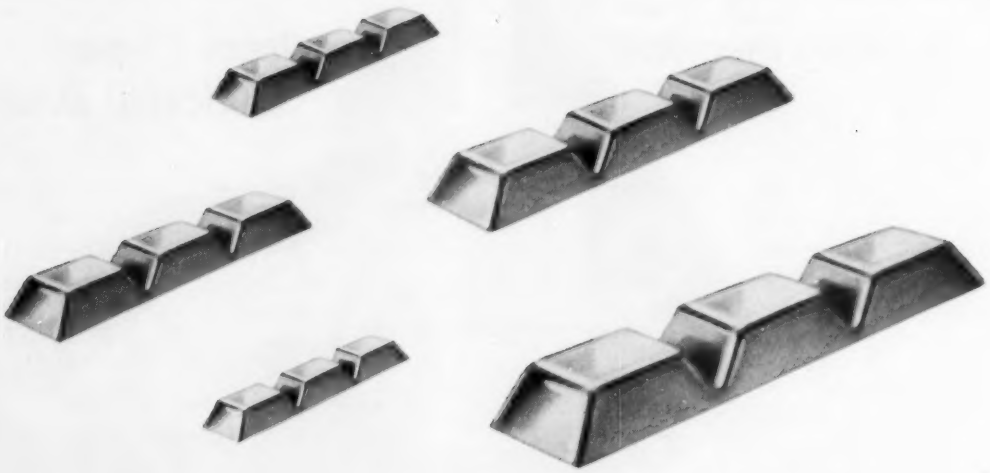
*Frozen Mercury Investment Casting

ALLOY PRECISION castings company

Dept. H-62
East 45th & Hamilton • Cleveland 14, Ohio

Circle No. 4 on Reader Service Card

ALUMINUM ALLOYS FROM SMELTERS HAVE PROVIDED FOR YOUR GROWTH



In peace or war, in good times or bad, throughout the past 40 years the Aluminum Smelting Industry, composed of many independent firms, has stood as the *one steady, dependable* source of supply for foundrymen and die casters. In times of extreme demand for aluminum for wrought products, or whether aluminum was scarce or plentiful, Smelters have always been your steady suppliers.

You have found this to be true, and year after year have rewarded the Smelting Industry with the bulk of your ingot business.

REGARDLESS OF THE DEMAND FOR ALUMINUM FOR OTHER USES AND DESPITE INTERMITTENT OFFERINGS OF INGOT ALLOYS FROM OTHER SOURCES, FOUNDERS KNOW THEY CAN RELY ON THE ALUMINUM SMELTING INDUSTRY TO CONTINUE TO SERVE FOUNDRYMEN FIRST.

Constant improvement of aluminum casting alloys and service to you have always been, and will continue to be, our major efforts.

—that's your assurance of continuing supplies of aluminum alloys as you want them—when you need them—always.

An interesting article on the Aluminum Smelting Industry, and its history appeared in the November issue of "Modern Metals." It's a question and answer article that tells many of the answers to questions bearing on your supply problems. Write for your copy today.

no foundry ever shut down because ingot was not available from smelters!

ASR

Aluminum Smelters Research Institute
20 North Wacker Drive, Chicago 6, Illinois

Circle No. 8 on Reader Service Card

Changes in personnel

Frank W. Ladky has been appointed assistant to the president for *Allegheny Ludlum Steel*

E. B. Rutledge has been appointed as acting treasurer and **E. G. Weissenberger** as sales manager of *Ferrod Mfg. Co.*, a wholly-owned subsidiary of *Ferro Corp.*

J. C. Wessel has been elected treasurer of the *Ferro Corp.*, according to an announcement from the company.

Carl C. Clabaugh has been appointed to the newly created position of sales manager of the metal cleaner dept. of *Cowles Chemical Co.*

H. Leon Moran has been named new products manager for the mechanical goods division, *United States Rubber Co.*

C. M. Knights has been named special representative for the Detroit area by *Hanson-Van Winkle-Munning Co.* Other appointments announced by the company are: **J. D. Kershaw** district manager of Michigan, **Calvin E. A. Solla** district manager of Ohio, and **Hilton M. Smith** sales representative for the Boston area.

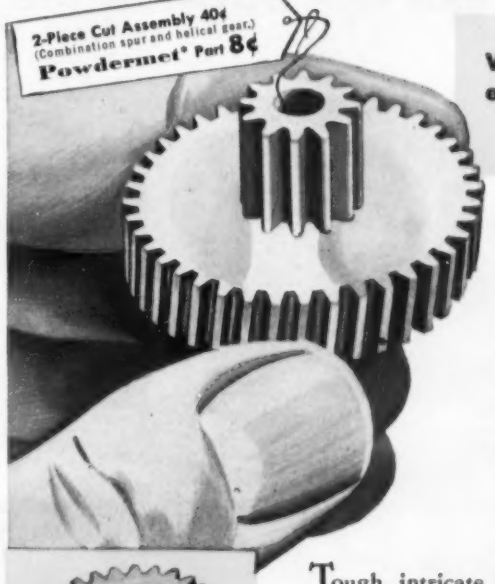
Edgar W. Engle, manager of product and process development engineering, *Carboloy Dept., General Electric Co.* has been named manager of cemented carbide products engineering.

Quentin S. Stump has recently been appointed national sales manager for *Lord Chemical Corp.*

Charles J. Auger has been named sales representative for the state of Michigan and **Frank J. Johnson** for metropolitan New

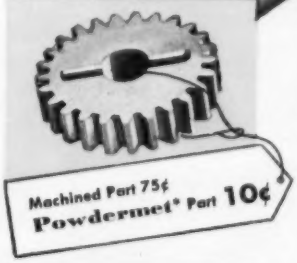
Continued on page 24

DON'T CUT PARTS ...Cut Costs!



Why pour money into expensive machining operations?

POWDERED METAL PARTS can do the job for *much less!*



Tough, intricate parts ready for assembly without further processing—at *savings of up to 600% over identical machined parts!* No wonder industry chooses Powdermet.*

Low-cost PM parts are die-pressed to close tolerances, have excellent wearability, and a wide range of alloys are available—many exceeding the tensile strengths of mild steel. Through controlled porosity and electrical permeability, many special properties are achieved . . . such as oil-impregnation for life-time self-lubrication. That's why Powdermet* parts are often the *best parts possible* for gears, bearings, filters, etc.

At Yale & Towne, years of experience and technological know-how in powder metallurgy back up every recommendation on PM parts for *your* particular application.

The world's most famous key . . . symbol of industrial leadership!

YALE & TOWNE
MANUFACTURING COMPANY
PMP *Powdered Metal Products Division*
9335 Belmont Avenue • Franklin Park, Illinois

Get your copy of this informative new booklet now!

*TRADE-MARK

—Send Today For Free Booklet—

The Yale & Towne Manufacturing Company
Powdered Metal Products Division
9335 West Belmont Avenue
Franklin Park, Illinois

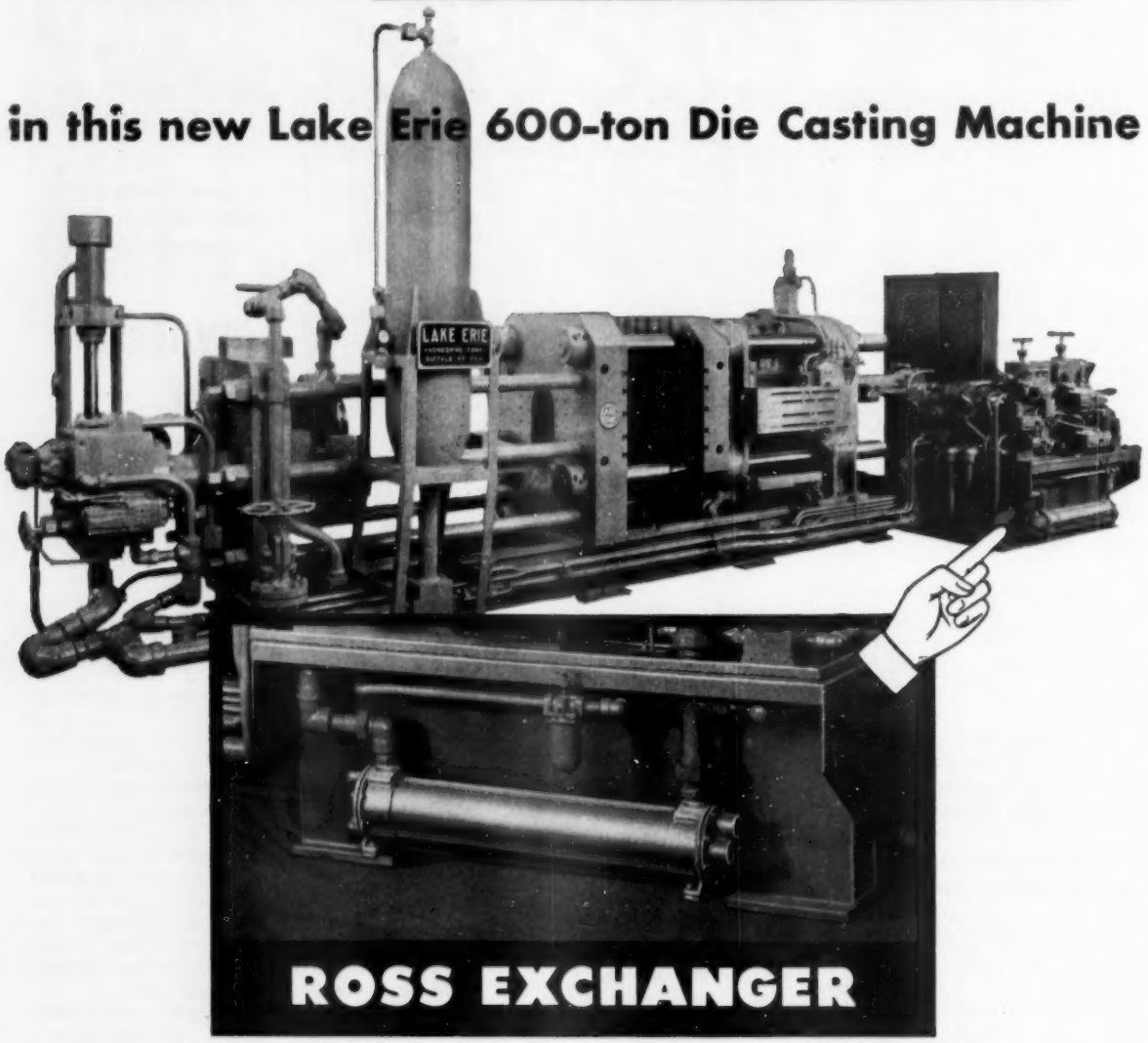
☐ Send Booklet ☐ Send information on PM parts for attached specifications or drawings.
☐ Have a Yale & Towne Powdered Metal engineer call on me.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

Circle No. 73 on Reader Service Card

maintains constant oil temperature

in this new Lake Erie 600-ton Die Casting Machine



Operating at 450 free cycles per hour and capable of producing aluminum castings weighing up to 12 lbs., this new Lake Erie Model A-60 Die Casting Machine is rated at a locking pressure of 600 tons.

To insure combined 2-pump capacity of 20.6 gpm at 1000 psi, by providing safe, dependable oil cooling, a built-in Ross Type BCF Exchanger has been provided. *Hydraulic power losses, caused by excessive temperature, are thus prevented!*

"Ross oil coolers are selected on the basis of performance, economy and availability," states Lake Erie Engineering Corp.

Rugged, dependable and top-rated for thermal efficiency, all copper and copper alloy Ross Type BCF Exchangers are preferred by manufacturers of numerous types of hydraulic machinery. Pre-engineered and fully standardized, they are stocked in a wide range of sizes to meet your needs . . . *promptly*.

For detailed information, request Bulletin 1.1K5.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1446 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS
Circle No. 41 on Reader Service Card

How to protect your aluminum supplies

... regardless of market conditions!

THE FACT that aluminum is rapidly taking the place of other materials in almost every industry means that the demand for aluminum will continue to grow. Every known authoritative forecast predicts this continuing growth. This means you should now assure yourself of *dependable* aluminum supplies—for the future as well as the present.

The best way to do this is to take advantage of Kaiser Aluminum's *unique position* as a supplier of pig, ingot and billet.

Today, our primary production capacity has reached almost 30% of the aluminum industry. Yet our greatly expanded mill product fabricating capacity—even at peak operating levels—consumes only slightly more than 50% of our primary production. Thus, we produce a larger proportion of pig, ingot and billet than any other supplier—not for our own use but for sale.

We not only can, but do supply a larger percentage of primary aluminum to foundries and fabricators than any other domestic producer. And—we repeat—*regardless of market conditions!*

For these reasons, we feel that we are ideally suited to help you make the best use of aluminum's many advantages which include light weight with strength, workability, corrosion resistance, economy.

Contact the Kaiser Aluminum office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc. *General Sales Office:* Palmolive Bldg., Chicago 11, Illinois. *Executive Office:* Kaiser Bldg., Oakland 12, California.

Here's why users of pig, ingot and billet rely on Kaiser Aluminum!

Faster service and delivery on orders from our conveniently located plants at Newark, Ohio; Chalmette, Louisiana; Halethorpe, Maryland; Mead and Tacoma, Washington.

Dependable source of supply because we are an integrated producer.

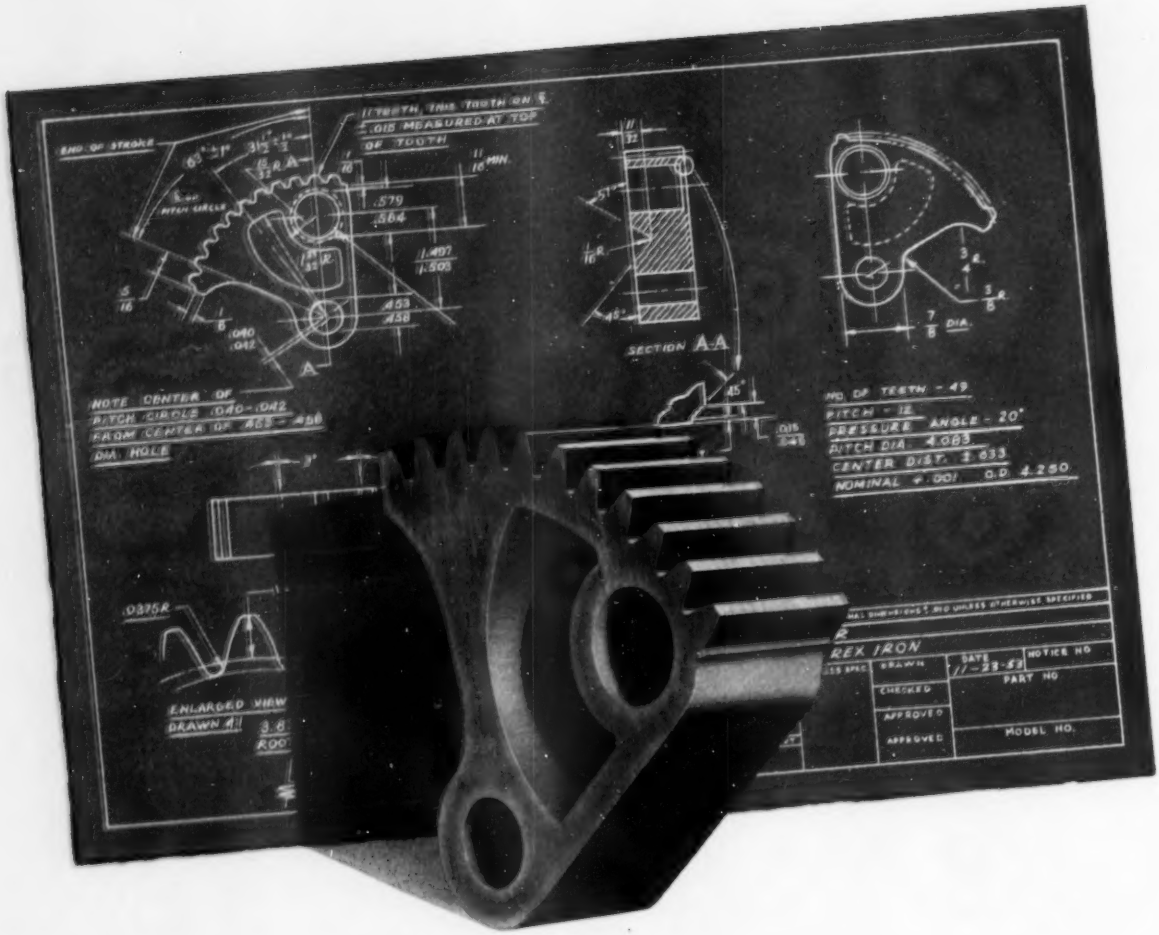
Outstanding engineering service, including design assistance and other technical advice.

Our ability to produce to all standard specifications or to all special customer specifications.

Kaiser Aluminum

The nation's largest supplier of aluminum pig, ingot and billet

Circle No. 40 on Reader Service Card



COMPLEX PARTS ARE A CINCH FOR MORAINE POWDER METALLURGY

By conventional casting and machining methods, this part would be high in cost and would require extensive equipment investment. Through the use of metal powder techniques, it has been mass-produced with important over-all savings.

Note the construction details on the print in the background. Formerly many machining processes were necessary before this part was ready to be assembled into a complete, operating mechanism. Now it comes from a press complete in a single operation . . . another example of what can be accomplished through cooperative effort between customer and Moraine.

Moraine's experience with metal powder is contributing widely to modern industry. Many complex designs are resolved into practical, economical production jobs that improve performance and lower costs.

m

moraine products

DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

METAL POWDER PARTS

When it's a... QUESTION of SAFETY...

the ANSWER *is* UCON hydrolubes

Trade-Mark

"What are Ucon hydrolubes?"

Ucon hydrolubes are Carbide's water-base safety hydraulic fluids.

"Why do Ucon hydrolubes contain water?"

Water is the key to their non-flammability. Actually, Ucon hydrolubes are balanced formulations of water, a synthetic lubricant, an anti-freeze, and selected additives. As long as the water concentration is maintained, Ucon hydrolubes *stay* non-flammable.

"Are they water emulsions?"

No, the special synthetic lubricant in Ucon hydrolubes is completely soluble in water.

"How do Ucon hydrolubes affect wear in my machines?"

Special anti-wear agents in Ucon hydrolubes provide satisfactory pump life and performance characteristics—as shown in more than 6 years of routine use in a variety of industrial hydraulic equipment.

"Will Ucon hydrolubes damage the metals in my machines?"

Ucon hydrolubes contain effective liquid and vapor phase corrosion inhibitors for protection of metals including steel, aluminum, brass, and copper.

"Can I continue to use the same kind of packings and seals?"

Yes. Ucon hydrolubes have no harmful effect on standard packings and seals.

"What about leakage?"

Leakage losses are often lower than with regular hydraulic fluids.

"How do I go about changing over?"

Drain the old fluid from the system, follow the cleaning procedure that Carbide recommends, and refill with Ucon hydrolube.

"What are the viscosities of Ucon hydrolubes?"

200, 300, and 550 S.U.S. at 100°F. Other viscosity grades can be supplied to fit specific requirements.

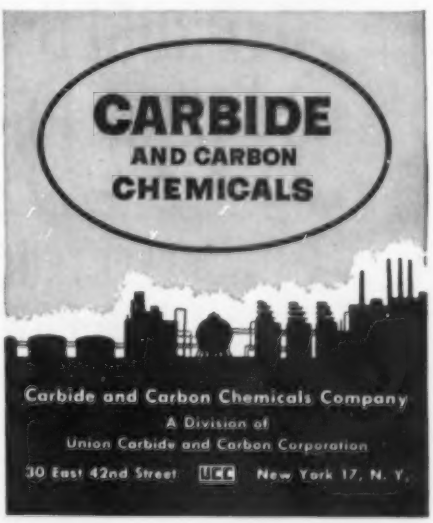
"How do temperature changes affect the viscosity of Ucon hydrolubes?"

Ucon hydrolubes have high viscosity indexes (150 to 160), and low pour points (below —55°F.).

"Are they safe to use?"

Yes, Ucon hydrolubes can be considered non-toxic for all practical hydraulic purposes.

✻ *If you have questions—or would like to know more about* Ucon *hydrolubes—write today for the booklet,* "Ucon *Hydrolubes*" (*Form 7380*). *In Canada: Carbide Chemicals Sales Company, Division of Union Carbide Canada Limited, Toronto.*



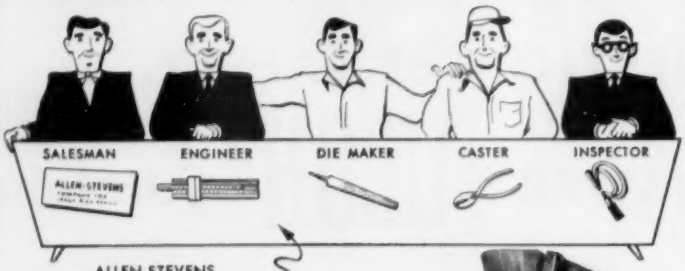
"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

Circle No. 23 on Reader Service Card

Circle No. 13 on Reader Service Card

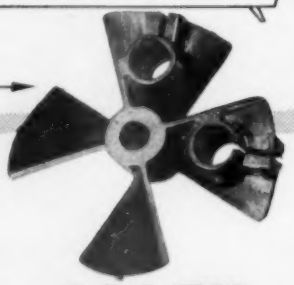
ALLEN-STEVENS PRESENTS

WHAT'S YOUR LINE?



ALLEN-STEVENS PANEL OF EXPERTS

GUEST DIE CASTING →



CLUES:
1. There's one in almost every home.
2. Air flows over it constantly.
3. It does *not* turn in use.
4. It's used to put the heat on you.

SOLUTION:
It's a TURBULATOR, used in oil burner tubes to spin air for better combustion. The center hole is for fuel feed, outer holes are for ignition electrodes.

COMMERCIAL:
Whatever your line, Allen-Stevens can make metal parts by die casting for you which are: 1) top quality; 2) delivered speedily and on time; 3) at rock-bottom minimum cost. Can we save you money? ***Put a chart or print*** in the mail today for engineering advice. No obligation. Or ask for free die casting design literature.

ALLEN-STEVENS CORPORATION
62nd St. at 34th Ave.
Woodside 77, New York
DEfender 5-3000

Pyron Corporation

Producers of

HYDROGEN REDUCED IRON POWDER

And Distributors of

ELECTROLYTIC IRON POWDERS

Niagara Falls, N. Y.

For information write PYRON CORP., Box E LaSalle Station, Niagara Falls, N.Y.

Circle No. 62 on Reader Service Card

CHANGES IN PERSONNEL

continued from page 19

York and northern New Jersey for *Metalwash Machinery Corp.*

Industrial Foundry Supply Co. has been appointed exclusive sales agents for northern California and **Gordon Sondraker & Co.** as exclusive sales agents for southern California for the complete line of *Shieldalloy Corp.* products.

Joseph Saks, director of sales for the *Gries Reproducer Corp.* has announced the appointment of **Carl E. Von der Heide** to represent the company in Michigan and part of Indiana.

S. K. Derderian has been named general manager of *Metal Hydrides, Inc.*

Robert L. Holloway has been named chief engineer of the Advanced Engineering Department and **Herbert E. Oles,** chief engineer of the Buffalo Product Engineering Department, both newly created departments of *American Machine & Foundry Co.*

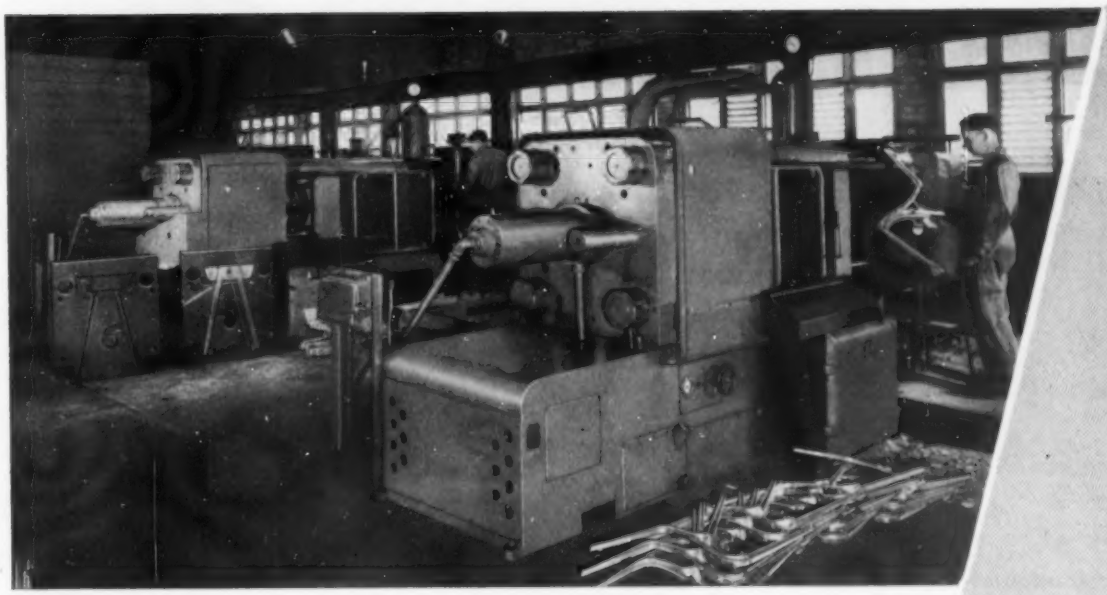
John W. Shier, production manager of *Acheson Colloids Co.* has been elected chairman of the Detroit Section of the American Institute of Chemical Engineers for 1954-1955.

Jack H. Senger has been appointed sales engineer in the Detroit area by the *Udylite Corp.*

Dr. David I. Sinizer has joined the metallurgical research dept. staff of *National Research Corp.*

Phillip Borell has been made representative in eastern Pennsylvania and adjacent New Jersey areas for *Allied Research Products, Inc.*

R. Lindley Murray, president of *Hooker Electrochemical Co.* has announced several personnel changes. **Hiram B. Young** is now vice president in charge of eastern production; **Thomas E. Moffitt** is the new vice president in charge of western operations. **F. Leonard Bryant** is the new works manager at the Niagara Falls plant.



It may seem like kids' stuff to you -

but it requires a high standard of precision die-casting to produce this aluminium furniture

PECO

DIE-CASTING MACHINES

The boys and girls are very much a concern of the State to-day—and notably is this shown in school equipment. Desks and seats are not the cumbrous articles of earlier, Spartan days. Made of aluminium, they're light, bright, strong, comfortable—distributed in thousands by the Educational Supply Association as Stevenage, who utilise Peco Die-Casting Machines in their production. These PECO machines have modernised the technique of cold chamber pressure Die-Casting. They have as a unique feature electrical control covering every movement of the cycle. The four core-pulling connections, hydraulic ejection cylinder and bumper bars for mechanical ejection are fully interlocked, permitting operation in any sequence, and, by use of the hydraulic ejector as a core-puller, the effective die-opening can be increased by as much as six inches.

Illustrated literature will be gladly sent on request.

PECO PRODUCTS

ENQUIRIES TO:

PECO MACHINERY SALES (Westminster) LTD.

28 VICTORIA STREET, LONDON, S.W.I. ENGLAND

TELEPHONE: ABBEY 1793/4/5: TELEGRAMS: PROFECTUS, SOWEST, LONDON: CABLES: PROFECTUS, LONDON

WORKS: PROJECTILE & ENGINEERING CO., LTD. ACRE STREET, LONDON, S. W. 8, ENGLAND

Circle No. 81 on Reader Service Card

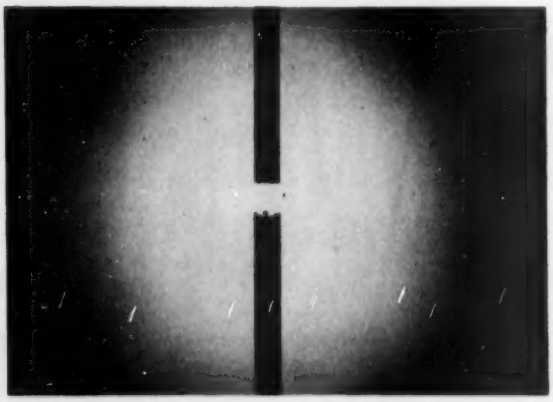
CANDID SHOT

. . . of Bunker Hill, the practically lead-free Zinc!

Examination of the spectrum emanating from the vaporization of the zinc sample and recorded on spectrographic plate quickly reveals the chemical content of the sample. The spectral lines indicate which elements are present and to what extent. Iron, lead and cadmium are the most commonly found impurities, but by far the most harmful from the standpoint of die casting is lead. Note the "lead" line of Bunker Hill zinc. It is hardly visible. It tells the story of an exceptionally low lead content in a zinc running consistently 99.995+% pure.

Bunker Hill, the first commercially available four-nines metal has never failed the die casting industry in consistency of purity. The elimination of lead from zinc was a notable advance in the art of zinc refining, and the enormous expansion in the use of zinc base die castings is the direct result of this outstanding metallurgical achievement.

DIE CASTING is the Process . . . ZINC, the Metal . . . BUNKER HILL, the Preferred Zinc



A spectrograph is basically a picture of a spark. All elements, when "excited" by heat or electrical discharge, emit radiations of known wave lengths, usually measured in Angstrom units (Å). In spectrography, this light is dispersed into its component parts (the spectrum) and recorded on a photographic plate. The wave lengths are always the same regardless of what other elements are present in the substance under investigation, and since these wave lengths are accurately known it is possible to identify each line in the spectrum and thus gain a complete knowledge of the composition of the metal. The density of the spectral line bears a direct relation to the amount of the element present, therefore the spectrograph also provides a basis for quantitative analyses.

Eastern Sales Agents: **ST. JOSEPH LEAD CO., 250 PARK AVE., NEW YORK 17**

BUNKER HILL 99.99+% ZINC

Sales Office for Pacific Coast: **NORTHWEST LEAD CO., SEATTLE, WASH.**

24 HOURS OF "BACK TALK"

...but none about these die-cast parts

CASE HISTORIES FROM MT. VERNON FILES

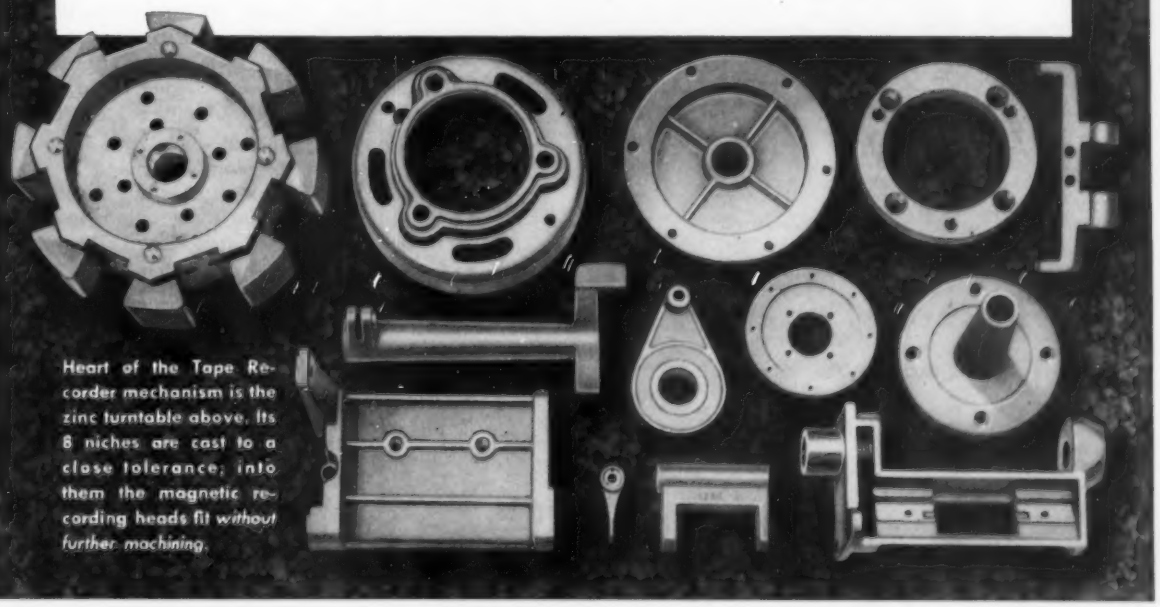
Soundscriber's new 24-hour Magnetic Tape Recorder and Reproducer is the first in its field to provide such a long period of continuous, unattended recording in so small an instrument. It weighs but 80 pounds.

One important reason why this precision instrument is so light, so thoroughly practical, yet so moderate in cost, is the die cast aluminum and zinc parts you see here.

States Soundscriber Corporation: "From long experience with our standard line of dictating equipment, we have found die casting a lower-cost way of making intricate parts. Further, this method allows for more economical use of lightweight metals. Mt. Vernon die casting has always met our high quality standards."

Whatever *your* product, simple or intricate, it will pay you to consult with us. We have up-to-the-minute facilities for precision die casting of aluminum and zinc, and a vast reservoir of experience. It's quite possible that we can show you the way to greatly increased production, lower unit costs —improved products, too.

MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT



Heart of the Tape Recorder mechanism is the zinc turntable above. Its 8 niches are cast to a close tolerance; into them the magnetic recording heads fit *without further machining.*

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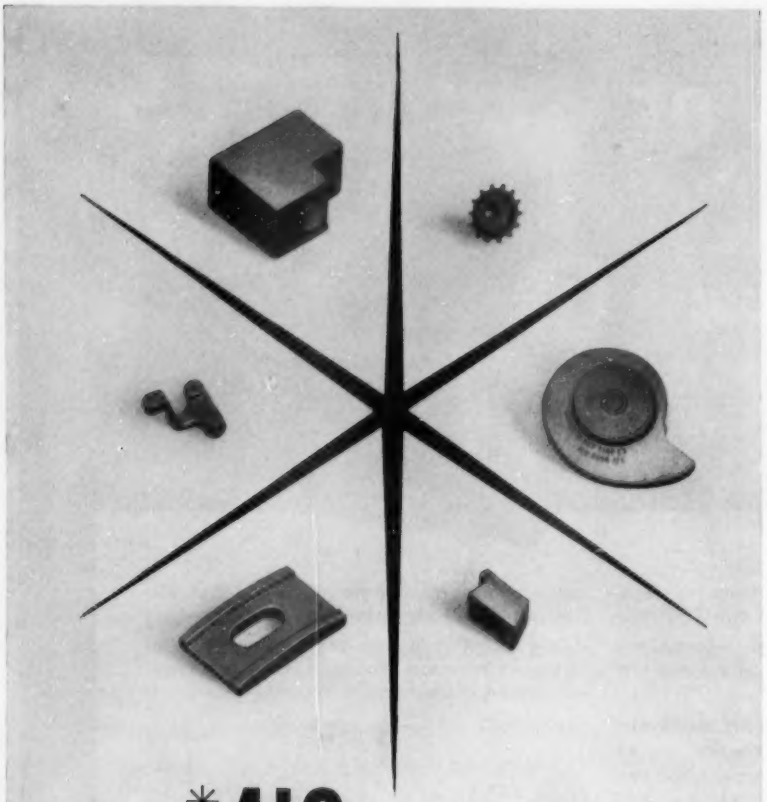

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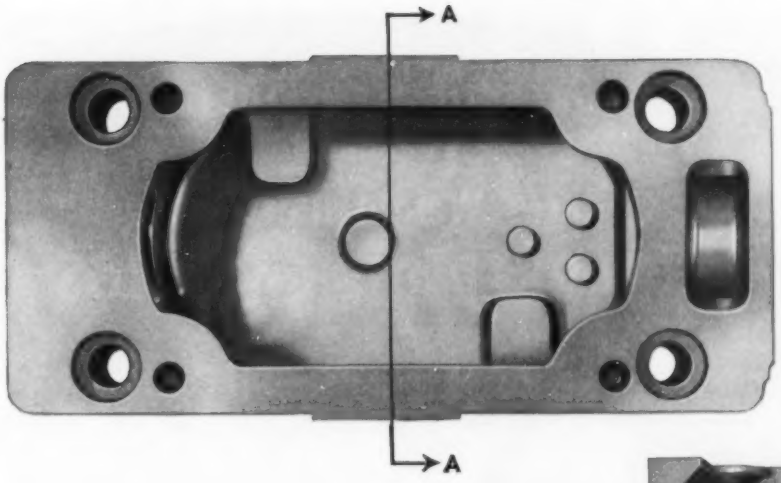
BOOKS

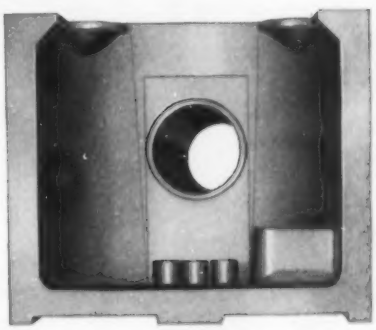
METAL WORKING TOMORROW; edited by Georges F. Doriot, Professor of Industrial Management, Harvard Graduate School of Business Administration; published by Metalworking Tomorrow, Box 86, Cambridge 39, Mass.; price $10.00.

This is a report of the various metal working processes that are either relatively new or in which new and almost revolutionary concepts have arisen. It was prepared as a group project by students at the Harvard Graduate School of Business Administration. The authors clearly define the scope of the report in the foreword . . . "The report contained in the following pages is the result of an effort to fulfill a need expressed by business men and determined by the authors' observation. In talking to business men and through surveying various published material, we became aware of the facts that significant developments were occurring in the art of metalworking; that individual business men were aware of only a limited number of these developments; that the information they did possess was inadequate to evaluate the significance of the development; and that published material was widely scattered and provided, at best, only partial treatment of various aspects of the development."

The book, thus, is not designed for technical men, engineers, or production men, but rather for management so that they will have some idea of the various processes.

The various processes covered are: continuous casting, shell molding, investment casting, powder metallurgy, cold extrusion of steel, hot extrusion, impacting, heavy pressing, formdrawing, electro-machining, electrolytic grinding, and ultrasonic machining.





Cross Section AA

Alert Designing

with MADISON-KIPP

Zinc and Aluminum Die Castings

The alert Micro Switch designer profitably defied tradition in the casting here illustrated, and developed a die casting with a die castable undercut.

Undercuts should, of course, be avoided whenever possible. When they are essential it is often a good idea to consult with the seasoned Madison-Kipp craftsmen for cooperative effort to help solve the problems involved.

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PARKER ALUMINUM *and* ZINC *Die Castings*

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Between the Lines of this and future issues

Take Another Look at Your Brass Parts . . .

How long has it been since you evaluated the costs on your small brass parts . . . pieces you have been turning out on screw machine, punch press or forging . . . to see whether you could save money? We'll bet you haven't given full consideration to powder metallurgy as a less expensive way to make them. Probably the reason is that you haven't realized what physical properties could be achieved by pressing and sintering brass powder. For a report on tests showing physical properties of powdered brass components, see the article in this issue of PMM.

You Pays Your Nickel and Tries Your Skill . . .

Those games of skill you see at amusement parks, bus stations and other public spots are frequently ingenious jobs of mechanical design, because John Q. Public too often thinks that his payment of a coin to operate the machines entitles him to kick, tilt, hammer or otherwise abuse the mechanism. Builders of games of skill have to make them so that they operate despite severe mistreatment. Die castings are very commonly used for functional components of these mechanisms, as reported in this issue.

Why Designers Should Know About Casting Methods . . .

Any designer who has ever argued over dimensional tolerances or cost of tooling with his supplier of castings knows it will be to his advantage to have a basic idea of the processes used to fabricate his components. It is also to the advantage of the vendor if engineers with whom he discusses prints have some idea about his method of fabricating. For that reason, PMM is offering a series of primers on each of the processes we cover editorially. We feel that designers and buyers of castings can do a more effective job if they are familiar with the steps needed to produce castings. In June we reported on plaster mold castings; in this issue we outline the steps in investment casting.

Field Report on Finishing Methods . . .

It is sometimes difficult to get finishing engineers to write articles about their methods, either because of company policy preventing description of actual methods, or unwillingness to take the time. PMM is fortunate to have a specialist in metal finishing who will prepare frequent reports on new materials and shop experience in finishing. Next month, Lynn Sprague, a finishing specialist with Pesco Products, will report on silicone enamels over zinc die castings . . . how to apply them, how to prepare metal surfaces, some of the problems and how to overcome them.

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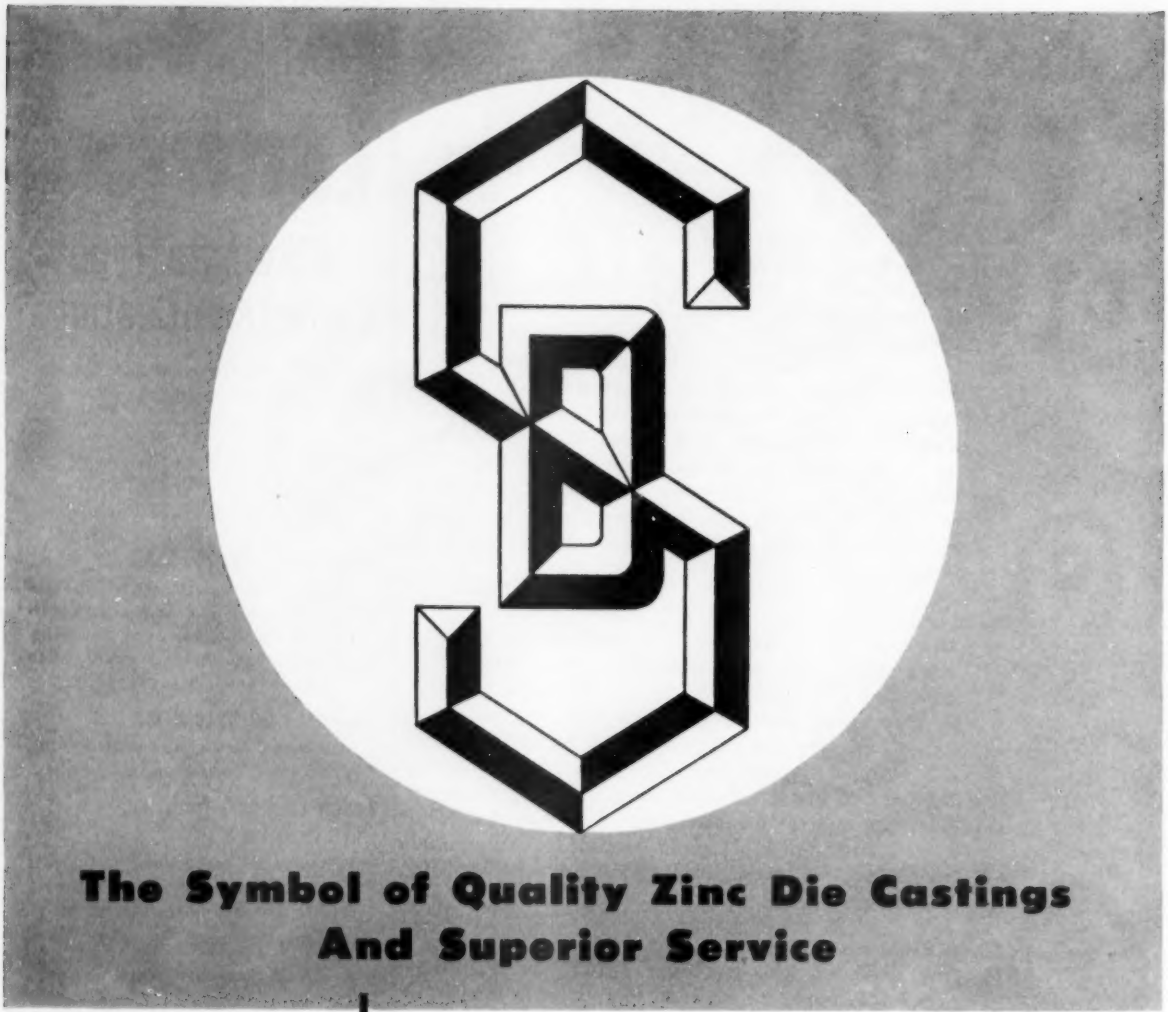

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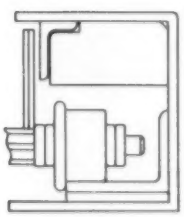
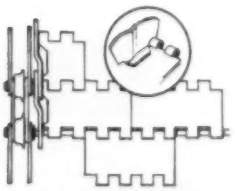
May-Fran hinged-steel conveyor belts



Construction details of "skirt" which prevents entry of foreign matter and protects side chains.



Outside links incorporate interlocking wings . . . remain positively engaged at all times.

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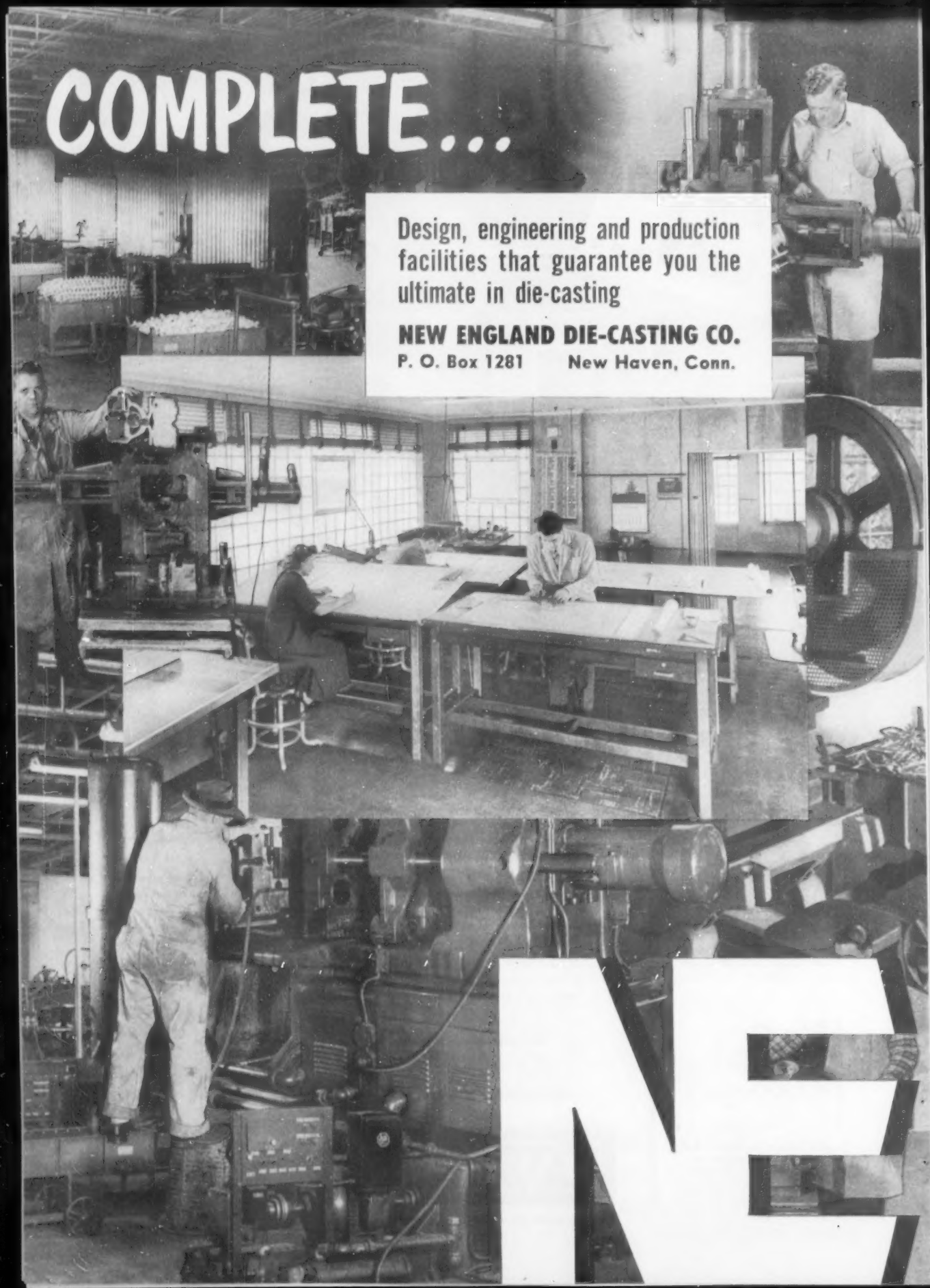
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Design Skill For A Game of Skill

PUBLIC be amused . . . might be the slogan of builders of coin-operated games of skill who know that amusing the public is not an easy task. In the public, they find not only a ready customer, but also an "adversary" who tests the mechanical ingenuity of their product with every sort of abuse.

The variety of games of skill is great, and the mechanisms for controlling, scoring or otherwise operating them often require the design of complex devices. These give smooth, dependable performance, even though the public never sees and rarely considers the engineering skill that goes into an apparently simple game.

As an example, one of the most popular games to be found in amusement parks, resorts, arcades and similar places is the well-known Skee-Ball game manufactured by Philadelphia Toboggan Company of Philadelphia, Pa.

To the player, this game consists of bowling nine balls along a flat runway which has a hump at the far end. The hump sends the balls through the air in a trajectory toward a series of scoring rings. Ability to control the "flight" of the balls determines the score.

Continued next page

SCORING IS ACCURATE because this register is built of dependable components such as the three die cast zinc working parts illustrated above.

Behind the scenes is a complex scoring mechanism made up of a highly accurate linkage connected to a register which presents the cumulative score as each ball is thrown. The score can be seen by the player through an opening above the playing area.

Heart of the scoring mechanism is the register which consists of a series of score cards held on a rotating rack. When each ball passes through a numbered pocket, it actuates a linkage connected to the register. This rotates the register until stopped by a pawl when the card bearing the cumulative score is in position.

A further refinement is an attachment which stops the counting after nine balls have been thrown, thus preventing the holding out of balls from a previous game or using balls from an adjoining alley to obtain a higher score.

Construction Materials

In any public-operated device, the manufacturer must take extra precautions in choice of materials. Players too often consider their expenditure of a nickel or dime as a license to hit, kick, shake or otherwise abuse the mechanism. In addition, there are unlimited variations in tricks for cheating . . . all of which must be guarded against by the manufacturer.

Even in normal usage, wear and tear is an important factor, so that in order to keep servicing and repair at a minimum, the builder must select dependable components.

It is interesting to note that four important structural members of the scoring register for these Skee-Ball games are zinc alloy die castings, specified in this material because it is the least expensive way to obtain dependable components that are both complex and accurate.

One of these die castings is the flanged spindle on which the score cards are rotated; the other three die castings are part of the system which transmits motion from the linkage. All four are produced by Latrobe Die Casting Company.

Most heavily stressed in operation is the segment gear die casting (a). Not only is there impact on the gear teeth, but there is also a load at the intersection of planes between the gear and yoke.

Strength and durability of the gear teeth are adequate, although when wear on the teeth occurs, it is a simple and inexpensive matter to replace this piece with another die casting . . . it is far less expensive, in fact, than to machine accurate gear teeth from a sand casting.

To overcome shear stress at the intersection of planes, an ample fillet has been provided. At every point in these castings which must carry load, increased section or enlarged radius has been provided. Note, for example, the reinforced edge of the link arm (c).

Zinc is a good bearing material for light or intermittent duty, and therefore all shaft or pivot holes are used without bushings.

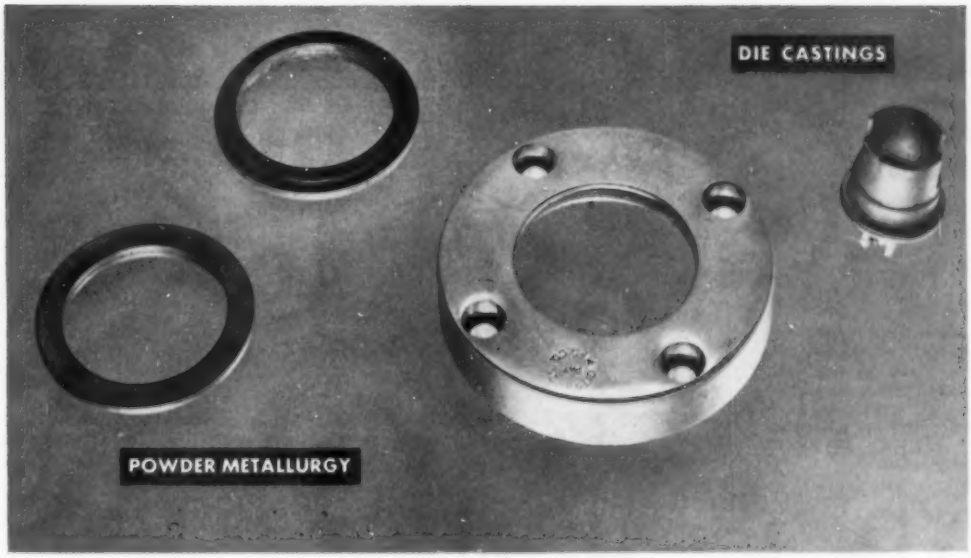
Tooling vs Piece Costs

Annual quantities of production are not large, as generally considered essential to the use of die castings, yet Philadelphia Toboggan Company has found it economical to spend money for dies. How does this practice justify itself in view of the limited annual ammortization of the tool investment?

There are two factors to be considered here. First, since the company acquired manufacturing and all proprietary rights to the Skee-Ball game in 1945, (these games have been manufactured since 1928) they have improved the design and stabilized it. With stable design, it is possible to spread amortization of tooling over a longer period.

Second, the large amount of machining and assembly would not only increase the piece cost of rough sand castings or assembled stampings, but would also require investment in heavy machine tools. The amount of saving when

Continued on page 80



Get More For Your Money...

by choosing a PMM process that gives better performance at lower cost.

THE most cogent reason for using any of the precision metal molding methods is to lower manufacturing costs. In some instances, other reasons will enter into the decision as to fabricating methods but except for the relatively rare cases where peculiar or particular properties specifically dictate a method, cost is the underlying motivation.

The three different parts shown are illustrative of the metal powder parts and die castings used by the Gits Bros. Mfg. Co.

The powdered bronze rings are component parts of a shaft oil seal. Functionally these rings help to prevent the leakage of oil along the rotating shaft. They are pressed onto the shaft and rotate with it.

These mating rings were formerly machined from bronze bar stock with attendant material waste and inaccuracies attendant upon operations largely dependent upon human judgment.

With conversion to powder metallurgy as a manufacturing method, the parts are highly uniform from piece to piece. Material waste is eliminated, inspection costs sharply reduced and screw machines which were formerly tied up making these parts are now free for other work.

The net result of the change in manufacturing method is then, a better part at reduced costs.

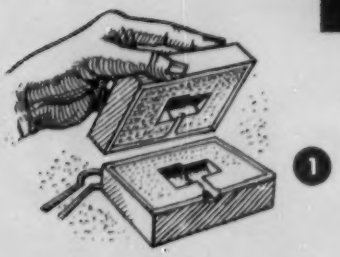
Two zinc die castings illustrated are: gear case oil sight glass housing and the body of an oil cup. Both of these parts were designed originally as die castings and in that respect differ slightly from the powder part just discussed which was a conversion. In the case of these two parts, early engineering cost estimates showed very clearly that die casting was, by far, the most economical method of manufacture.

The gear case oil sight glass housing has been designed so that it can be die cast as a completed unit, needing only surface finishing to be done after casting. This part fastens onto a cast boss on the housing, and shows the level of the oil in the case. After the housing is received from the foundry it is buffed and polished and then plated. In most cases, the finish is chromium.

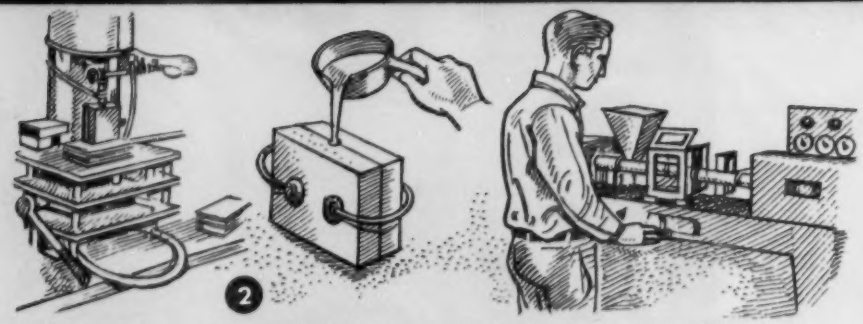
The oil cup body again designed originally as a zinc die casting cannot be fabricated by the foundry as a completed unit. Because a spring loaded cover must be installed, a small amount of machine work must be done on the bodies. This work, however, is quite simple, generally a matter of drilling one hole for the pivot pin.

These oil cups usually receive no surface finish other than a phosphate or chromate treatment to improve the corrosion resistance. Where necessary for appearance, they may be plated.

INVESTMENT CASTING



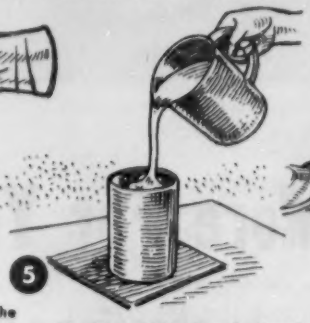
A mold or die, generally of hardened steel, is used to make the wax or plastic patterns. This mold is an exact negative of the part to be made with allowance made for wax, plastic and metal shrinkage.



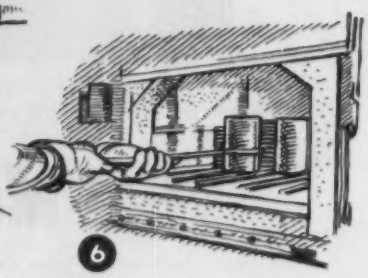
Molten wax (left) or polystyrene plastic (right) are injected into the mold using some type of automatic or semi-automatic machine. In the Mercast process, patterns are made by pouring liquid mercury into the die and freezing it (center).

The patterns are mounted on a central riser to form a "tree". With wax or mercury patterns this is a hand operation, the individual patterns being welded to the riser. On plastic patterns assembly is often by keyed interlocking parts.

First step of investing is the application of a dip coat. A very finely divided siliceous material suspended in an appropriate liquid carrier; application is by hand dipping. This step provides the smooth, accurate surface detail of investment castings.



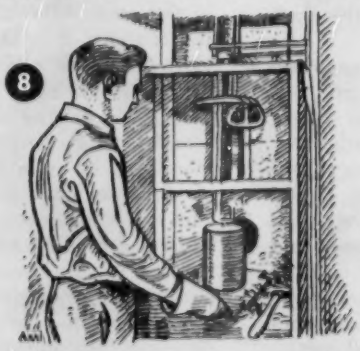
The dip-coated pattern is placed in a flask and the balance of the investment material poured in. Generally the flask and contents are vibrated during setting to insure good packing and removal of air pockets.

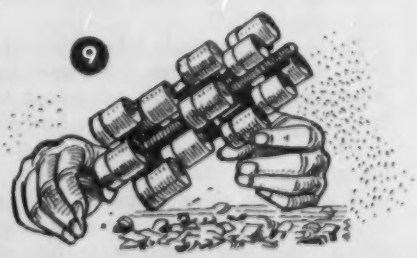


When the investment has dried the wax or plastic pattern is melted and allowed to run out through the gate. The invested mold is then heated to an elevated temperature to burn out residual pattern material and cure the mold material.

Molten metal is poured into the hot mold. Casting may be gravity (left), centrifugal (center) or inert atmosphere combined with gravity pour (right). Size and shape of part, alloy choice and metallurgical quality of castings will determine best method of casting.

When the tree of castings has solidified, the mold material is broken away. Air hammers, vibrating devices, etc. may be used here. This operation is similar to removal of a casting from a sand mold.





Individual castings are cut off from the tree and residual investment material removed by some type of abrasive blast.

ONE OF A SERIES OF

BASIC FACTS ABOUT THE

PMM PROCESSES FOR

DESIGNERS AND BUYERS

The Investment Casting Process

WHAT IT IS Investment casting is a process utilizing both an expendable mold and an expendable pattern. In the process, a steel mold is made that is a faithful negative of the part to be cast, with due allowances for shrinkages. Into this mold the pattern material in the liquid state is forced. This pattern material may be wax, plastic or mercury. After the pattern has solidified (in the case of mercury it is frozen) it is removed from the mold and coated with a silicious mold material of very fine grain size. This initial mold coating is then backed with a coarser mold material, both of these coatings being applied as slurries of the mold material in an adequate liquid carrier.

The mold is allowed to set, during which time hydrolysis takes place so that the individual particles are bonded together with either a silicate or phosphate material. The pattern is then remelted and allowed to run out of the mold. Following the melt-out the mold is heated to a predetermined high temperature and the metal poured in.

The final steps of shake out and cleaning are about the same as any other casting method.

By virtue of the finer mold material used the castings can be made with greater dimensional accuracy and smoother surfaces than by most other casting processes. Also by virtue of an expendable pattern which is removed in the liquid state, it is possible to make far more complex structures than can be made when a solid pattern is removed from the mold.

WHEN TO USE IT Generally speaking, investment casting is used when the decrease in the amount of subsequent machining more than compensates for any increased first cost of the casting. The process, in its present state of development, involves the production of steel molds for most parts, a large amount of skilled and semi-skilled hand labor and a slow production cycle.

However, the ability to produce configurations that are completely impossible by any other method and the assembly of a plurality of pattern pieces into a single unit to form a casting which would otherwise be an asembly of several castings or machined parts makes this process extremely attractive.

Depending upon the economics of production, the process may be used for the production of both small and large runs. Prototype die castings are frequently made by investment casting to perfect design before the highly expensive dies are made. Where, for strength or corrosion resistance, a substantially non-machinable metal is desired, an investment casting will often give a part that is completely or nearly finished in the as-cast condition.

Functional requirements may dictate a part shape that can not be machined economically, but which can be investment cast and used as-cast or with minor machining.

ADVANTAGES Dimensional accuracy, good reproduction of detail, smooth surface, sound metallurgy and good reproducible accuracy from piece to piece are the principal advantages of the investment casting process.

Dimensional tolerances, always dangerous to quote, may run in the order of $\pm$ 0.005 per inch. On some dimensions better tolerances are possible but only at increased cost per piece. Surface finishes vary depending upon the metal being cast but usually a 125 micro-inch finish or better can be secured; 60 micro-inch surfaces are relatively common, particularly in the brasses and bronzes.

EXAMPLES OF INVESTMENT CASTINGS →

Alloy Choice? Almost Unlimited

Because the mold is, to all intents and purposes, a monolithic structure, there is very little danger of either mold wash or spalling with consequent inclusions in the casting. The greater dimensional accuracy and improved surface result in far lowered machining on the casting and the improved structural soundness lowers rejects due to porosity.

Outstanding among the advantages of the process is the ability to combine a number of separate pattern parts into a single unit, thus eliminating separate machining and assembly operations, and gaining strength and rigidity by virtue of unitary construction.

In general, smaller holes can be cored than is possible by most other casting methods. When necessary the permeability of the mold can be varied to achieve specific properties. Wall thicknesses may be greatly reduced where desired (in some cases walls as thin as 0.020 have been cast) and this, in conjunction with better surface and greater accuracy, results in far lower scrap losses from machining.

METALS Any castable metal may be investment cast. Unlike most of the other precision casting methods where the mold material limits the choice of metal or alloy to the lower melting point materials, all of the ferrous base metals and alloys can be used.

While the above statement is made without any qualifications there are, of course, some more favored metals from the foundry point of view. Among the non-ferrous metals, beryllium copper is widely used because of its high fluidity. Very intricate castings can be made of this alloy and it has the added advantage of being age hardenable if desired.

All of the aluminum casting alloys are widely used as are silicon bronze, manganese bronze, nickel silver, and the commoner brasses.

Among the ferrous alloys 1020 and 1040 steels are generally favored in the plain carbon materials as are the 5100 series of low alloy steels.

Both the 300 series and the 400 series of stainless steels are widely used as investment castings. Among the other high alloy steels some of the most outstanding are the non-machinable high strength high temperature alloys used for turbine blading. In this latter group, investment casting is the only economical method of fabrication that has thus far been developed.

The precious metals can, of course, be investment cast as can tantalum, titanium and zirconium. The two latter metals still present some difficulties in casting on a commercial scale, but fairly large pilot plant casting is presently being done.

COST The casting, as delivered by the foundry will generally be more expensive than a rough casting from a sand foundry. Initial tooling costs are considerably higher than for sand casting, but the elimination of or decrease in the machining required will generally compensate for these increased costs.

As a general rule, tooling costs for investment casting can be justified if they do not exceed the tooling cost to bring a part to the same degree of finish. Since labor charges in an investment casting foundry are usually lower than for a skilled machinist any labor saving to bring the part to the same stage of completion as the as-cast investment casting represents a saving.

Subsequent machining on the cast part will be about the same regardless of the method of manufacture. However, a further saving is possible when assembly of two or more components must be made to arrive at the same part as a single investment casting.

Generally speaking, where investment casting is applicable, it will be found less costly provided cost comparisons are made at the same stage of completion.

There are, of course, those cases where costs must be subordinated to function. Where preferred design is possible by investment casting and not possible by any other process, then the application of this process is clearly indicated.

APPLICATIONS Turbine blading has been by far the greatest single application of investment casting. Even with the decrease in purchases by the armed services this application continues strong as civilian uses of the gas turbine, supercharger, etc. grows.

Other broad industry classes that are finding increasing uses of investment castings are sewing machines, both commercial and domestic, textile machinery, dental, surgical, and optical equipment, printing presses, motor components (both gasoline and electric), etc.

There is hardly any field of product manufacture in which fabricated metal parts are used that does not use investment castings to some extent.

Among the expanding use of investment castings is the building of special purpose machinery, ranging from packaging and conveying equipment to electronic tube making machines, from paper handling machinery to food processing units.

Instruments are likewise absorbing more and more investment cast parts in measuring, controlling, recording equipment, communications and scientific instruments, aircraft instruments, etc.

On the facing page are a number of typical investment cast parts and an indication of the field of use.

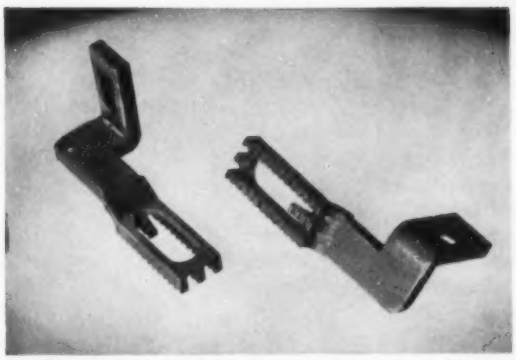
Tomorrow's Uses Include Wide Range Of Industrial Products

War-stimulated, the investment casting industry gained a firm grasp on manufacturing technique, cost reduction and metallurgical refinement on many ordnance and aircraft jobs. Now the future shows a healthy growth for industrial and commercial applications such as the sampling shown here.

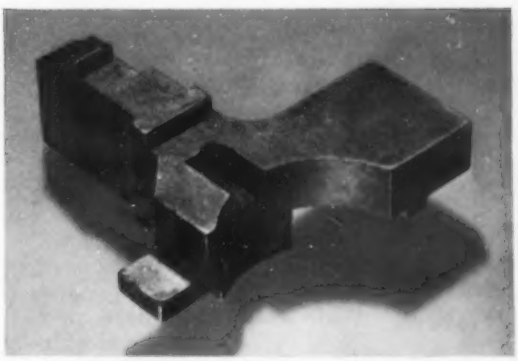
Pneumatic Tools

Business Machines

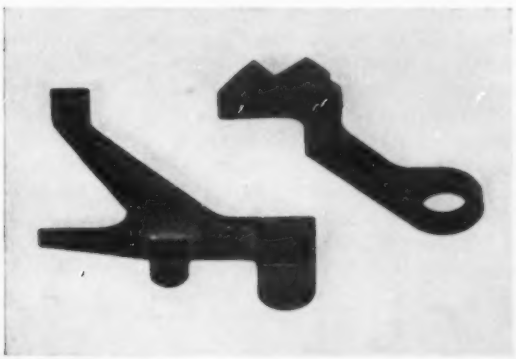
Special Purpose Machines



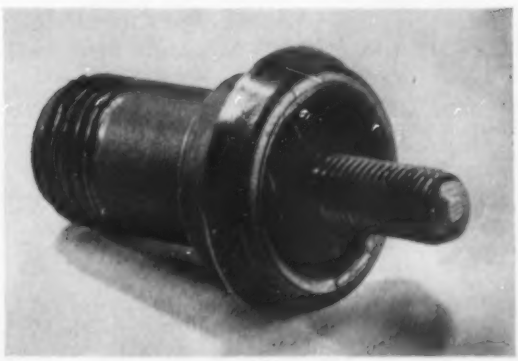
Sewing and Textile Machines



Printing and Typesetting Machines



Instruments



High Temperature Equipment

New Directions in Powder Metallurgy*

BY HENRY H. HAUSSNER, Manager, Atomic Energy Engineering
Atomic Energy Div., Sylvania Electric Products, Inc.

UNTIL very recently, it was the general belief that pure metal powder is the best raw material for powder metallurgical purposes and that the dimensions of products compacted from metal powders are limited by the size of the compacting die and the capacity of the press.

Recent developments in this country, as well as in Europe, have shown that these general beliefs are no longer generally true; superior powder metallurgical products can be obtained by pressing oxide-containing powder particles or even metal-compound powders, and certain new methods of powder metallurgy no longer limit the dimensions of the products. The following are a few examples:

Using Metal Compounds

The SAP Process The author had several discussions with Professor vonZeerleder, who invented the SAP process together with Dr. Irmann. SAP stands for a special "Sintered Aluminum Powder" which is characterized by its high tensile strength (50,000 psi) at room temperature and especially at elevated temperatures (35,000 psi at 400 C and 25,000 psi at 600 C). These sensational results were obtained by using a heavily oxidized aluminum powder of extremely small particle size. The oxide content ranges between 8% to 16% and determines the strength of the material: higher oxide content results in greater strength.

These results were obtained by compacting the heavily oxidized powder at 25 to 50 tsi, sintering it at 500 to 600 C in air. The sintered material is then hot-pressed at 500 to 600 C and subsequently extruded at the same temperature.

During the various pressing and extrusion steps, the oxide skins break up to extremely fine oxide particles which are uniformly dispersed around the aluminum grain boundaries. The SAP material is characterized by its fine grain size.

Metal Hydrides In certain cases, it is advantageous to use metal hydride powders instead of metal powders, to compact these hydride particles, to sinter the compact and, at the same time, to decompose the hydride. Experimental work was done extensively with zirconium hydride powders, which compact readily. During sintering in vacuo, the zirconium hydride decomposes and the pure metal is formed and sinters to full density at a temperature of approximately 65° of the zirconium melting temperature. Zirconium powder does not sinter as well as the decomposed zirconium hydride; the sintering temperature, in this case, is considerably higher and the densities achieved are somewhat lower. The use of the hydride powders, therefore, represents a considerable advantage and a big step forward in the powder metallurgy art.

Making Large-Sized Products

Sinter Welding Sinter welding represents a process of joining powder metallurgical parts by inserting a compound of the same metal, in powder form, between the two metal parts to be joined, and hot-pressing the assembly together. During hot pressing, the metal powder in between the parts decomposes and forms a bond between the two parts. Experiments with zirconium parts bonded by zirconium hydride powder showed that the sinter-welded joint is of practically the same grain structure as the two parts.

Rolling Metal Powders This method is used for the production of long bands or sheets from metal powders. The metal powders flow from a bin through two horizontally arranged rolls of a rolling mill. During the rolling procedure, the powders cohere and form a porous band or sheet which can be sintered, re-rolled and annealed until the desired density and other physical properties are obtained. The grain size of the powder, the roll diameter, roll speed and sintering conditions determine the physical properties of the finished material. This method permits the formation of bands and sheets of several hundred-foot-lengths.

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* Based on a paper delivered at the 2nd Basic Materials Exposition, Chicago, May 17-20, 1954.

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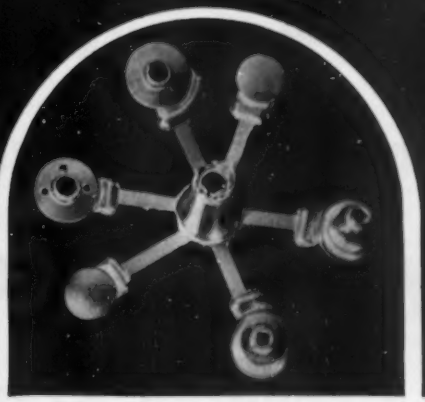

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POWDER METALLURGY

A Report To Product Designers On

Physical Properties Of Powdered Brass Parts

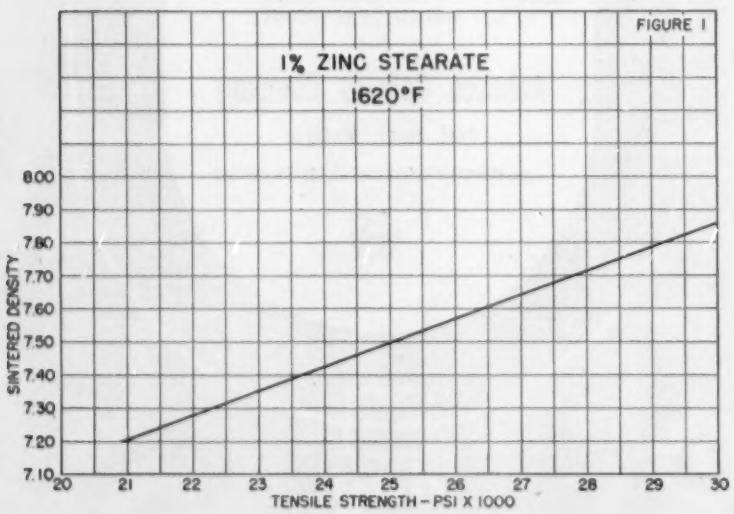
By D. C. BRADLEY
The New Jersey Zinc Co.

ALTHOUGH modern powder metallurgy goes back quite a few years, it is only within the past ten that brass sinterings have become at all widely used. Today they are found in many fields including builder's hardware, plumbing fixtures, ordnance components, farm equipment, communications and business machines. The advantages and limitations from a design point of view have been discussed frequently in the various trade publications and it is not the purpose of this paper to review or enlarge upon them. Rather it is the intent here to show some of the properties which can be achieved in properly fabricated brass sinterings.

In introducing a new product it is frequently necessary to furnish not only the material but also to assist the users in developing proper techniques for its use. This was certainly the case with brass powder.

Although many fabricators were working successfully with mixed copper and tin to produce porous bearings and structural parts or with iron powders, it was quickly found that brass powders could not be processed by the same techniques. In fact, it was only after considerable research and development work by The New Jersey Zinc Company and several fabricators that methods were developed for its proper use.

During this development period, much basic data was accumulated and although these data were of value to fabricators they were not directly translatable into usable material for design engineers. In fact, until recently, only a few very general aids could be offered them.



1. Tensile strength plotted against sintered density.

Knowing that reliable information was essential for proper design and general acceptance, The New Jersey Zinc Co. planned and is working on an extensive series of tests, duplicating as far as possible commercial production practices to determine what properties can be expected from brass powder parts.

It should be added that the American Society for Testing Materials has issued a military specification ML-B-12128 covering six brass powder compositions. Values shown in these specifications are in close agreement with those about to be discussed.

In planning the test program, it was decided to start with a prealloyed 80-20 leaded brass since this composition is most commonly used for parts production. The powder has a nominal composition of 78½% copper, 1½% lead and 20% zinc. Compacts were pressed on a Stokes press so arranged that accurate pressure readings could be taken.

Sintering was done in a 5-inch closed muffle, for ½ hour at temperature in a pure hydrogen atmosphere. Zinc stearate was used as a lubricant, various percentages being used to duplicate the variations encountered in normal commercial practice.

In all cases, standard Metal Powder Association test bar (standard 10-50 T Fig. 1) was used. Because it is usually quite difficult to measure accurate pressing pressures, results were correlated with the sintered density of the test bars. Density is easily determined without much specialized equipment and has been found to be a good indication of the properties of a properly sintered part.

Variables Affect Properties

There are many variables in powder metallurgy — there are in any industry. Because of these, as applied to sintering it is not possible to say that a properly pressed and sintered part will have a certain definite tensile strength or elongation or hardness. The density, sintering

Continued next page

Are Test Results Worth While . . . ?

It is always a problem in any production process to translate test bar data into usable data on actual parts, particularly when the pieces involved are too small to cut test coupons.

Hardness testing is not recommended for sinterings because of the porosity present although in some instances it is used as an indication of the degree of cold working done during coining. In any case, mutual understanding of the problems and cooperation between the fabricator and user are of utmost importance.

To show some of the procedures used in testing and also some of those applications where an understanding of the problems involved were appreciated by both the producer and his customer, the following examples of brass powder parts have been selected.

1. Lock Cylinder. Sintered brass lock cylinders have become one of the most outstanding applications in non-ferrous powder parts production. Yet the development of the methods of manufacture were not so simple as might be supposed.

For example, the face of the cylinder of one of these locks poses a problem. Under the best conditions, even when fully sober, a home owner will seldom put his key directly into the key slot but rather will miss and slide the key across the face until it hits the keyway. To prevent scratches, it is advantageous to harden that surface and yet, it is not necessary to harden the entire part.

Methods were developed to coin the face and yield this more scratch-proof surface.

2. Rotors. An example of a testing procedure is demonstrated by a small rotor produced for Ordnance.

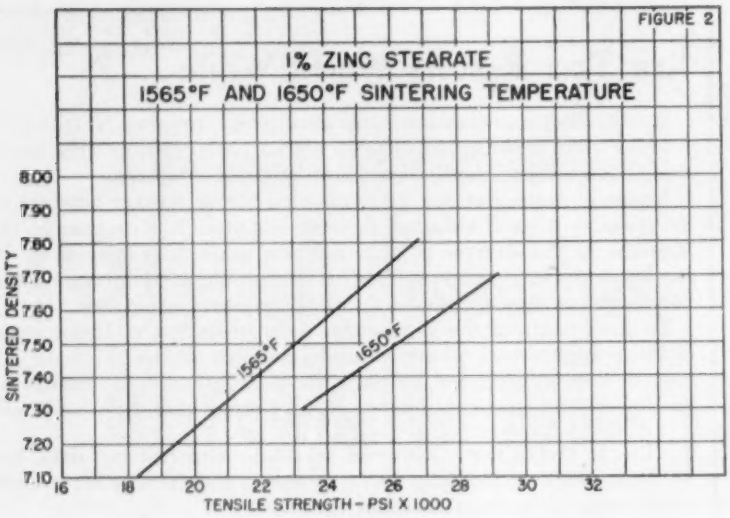
Although, the piece is too small to cut out test coupons but since the part is an ordnance component, some means of testing is essential. After considerable, painstaking work by a number of producers and the Ordnance Department, a crush test was established. In this test, the rotor is set on edge and squeezed until it cracks through the lower edge of the large hole. Minimum crush values have been established and included in the purchase specification. Actually, the test is simple and although difficult to correlate with test bar data, has proven a satisfactory acceptance method.

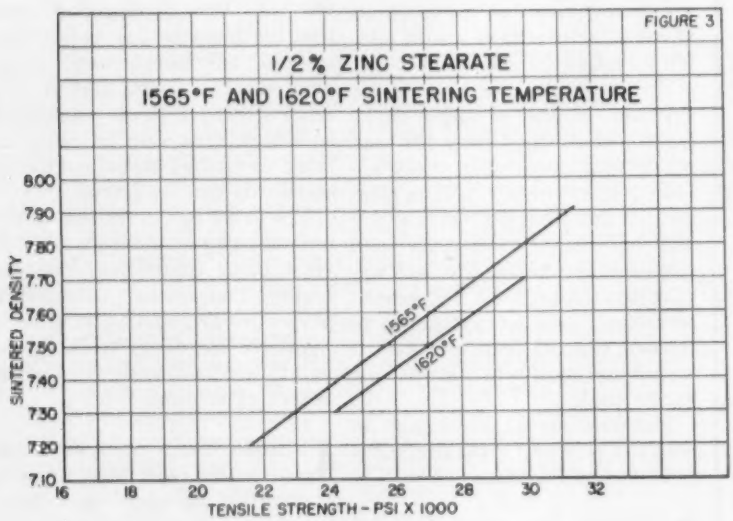
3. Drive bar. Several times it has been mentioned here that hardness testing is not considered too satisfactory. However, where a single part in very large quantities is concerned, sufficient data can be accumulated so that by statistical means standards can be set up.

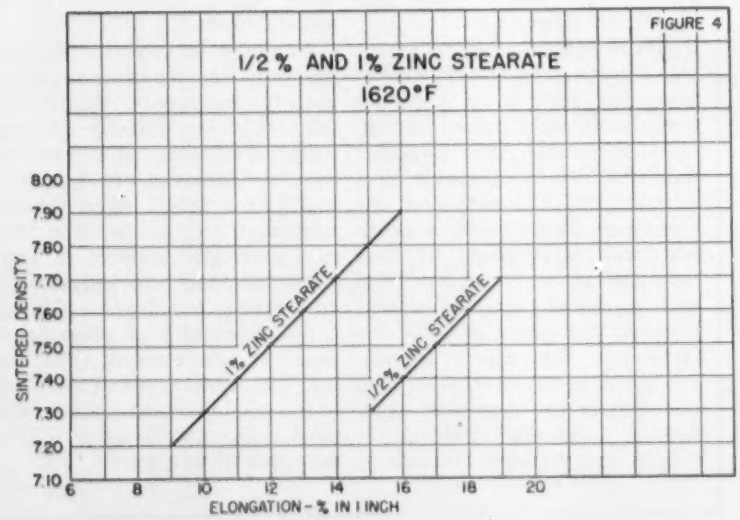
The drive bar in the dial of the new design telephones is used in very large quantities. Because higher than usual mechanical properties are needed, coining is required. Hardness tests, Rockwell H, are used to determine the degree of coining.

4. Slider. Sometimes, the shape of a part will lend itself to a modified standard test practice, by placing it in a fixture and running an impact test. Here again, minimum values are established.

In by far the majority of parts, the only testing or acceptance basis is dimensional. Usually the fabricator can tell by making frequent dimensional checks just how his furnaces are functioning. (As a result, even though tolerances may not be important in a particular application, constant checking is practical.) In any event, powder metallurgy is not different from other processes in one respect. That is, that the reputation and integrity of the producer is still one of the most important features in the purchase of any part.







Physical Properties Can Be Varied By Processing

Brass Powder — cont.

temperature and time, and percent of lubricant can all cause variations in the results. Therefore, the following graphs will present data determined under various combinations of conditions. From them it is hoped that a better realization may be had of some of the many problems confronting the fabricator.

As a start, consider parts containing 1% zinc stearate and sintered at 1620 F. In Figure 1, the tensile strength is plotted against sintered density. Notice that the values lie in a straight line indicating that *the higher the density, the higher the tensile strength.* This holds true regardless of sintering temperature or percentage of lubricant and it is logical that it should.

Sintered density is an inverse indication of the amount of porosity present and the less porosity or the higher the density the more nearly a part approaches the solid state.

Now, consider two extremes. First a series of bars sintered at 1565 F. or actually those at the lowest practical sintering temperature and second, a series sintered at 1650 F. at which temperature an appreciable percentage of parts will blister. Again 1% zinc stearate is used as a lubricant.

Both sets of data are plotted, as before, against sintered density in Figure 2. Perhaps the

2. Tensile strength vs sintered density at two sintering temperatures.

3. Tensile strength vs sintered density using 1/2 percent lubricant.

4. Elongation at various sintered density levels.

most important point to make here is that the greatest variation between these two extremes is 3,500 psi which is not, after all, excessive.

Now, what happens if less lubrant is used, keeping the other conditions the same. It should be mentioned that the amount of lubricant is in part governed by the complexity of the tooling: the greater the complexity, the more lubricant that is required. The amounts used vary generally from approximately ½ to 1 percent. Figure 3 shows the results when using ½%, sintered at 1565 F. and 1620 F. It was impossible to obtain data at 1650 F. because all parts blistered.

Perhaps the most interesting feature of this set of curves is the relatively little difference between the two extremes of temperature. Note that the tensile values shown are consistently higher than those shown for 1% lubricant. This is to be expected since the lubricant is votalized prior to sintering and creates additional porosity. Therefore, *the more lubricant, the greater the porosity, other things being equal.*

Ductility

One of the major advantages of brass sinterings is the relatively high degree of ductility which can be developed compared to other commonly used powders. In mixed bronzes or iron powders, 1 to 2% is considered acceptable. In the case of 80-20 leaded brass, 10 to 12% is not at all unusual. In Figure 4 is shown the percent elongation at various sintered density levels. For this graph, pressed powder parts with ½% and 1% lubricant, sintered at 1620 F have been used.

As might be expected, the greater the amount of lubricant, the lower the ductility. However, notice that even at the low density of 7.20, the 1% sinc stearate bars have an elongation of 9%. At the more commonly occurring density levels of 7.4 to 7.6, elongation at 1% lubricant is from 16 to 18%.

If we plot values for the extremes of the sintering range as before, using 1% zinc stearate, Figure 5 shows that *there is a variation at a given density of about 6% elongation.* When you consider that this is the spread in ductility, as measured by elongation, over 85 F. of sintering range and that the lowest values are still in excess of most bronze and iron powder parts, it is apparent why brass is specified where this property is required.

Sintered Density vs Properties

It is now apparent that the higher densities produce higher tensiles and greater ductilities. It would seem, therefore, that the parts producers should and would consistently work to den-

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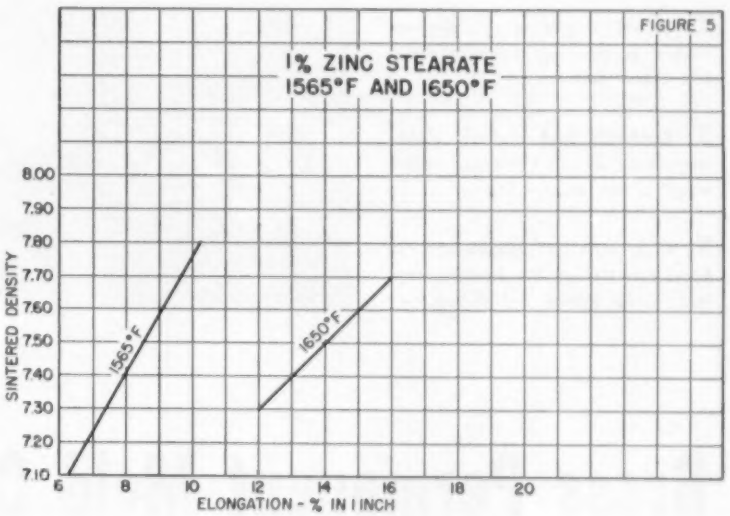
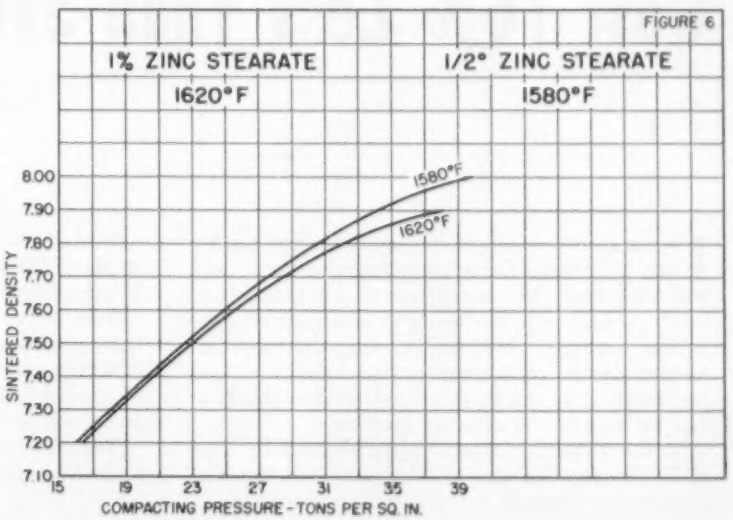
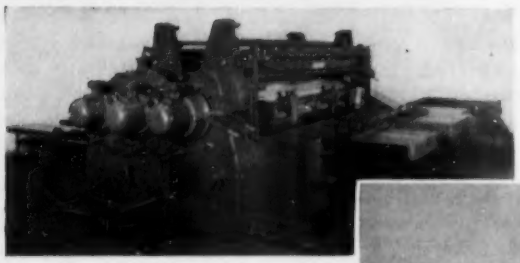
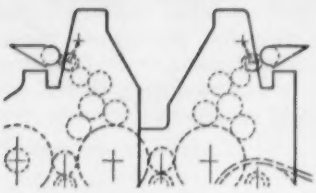


5. Effect of temperature of sintering upon elongation.



6. Pressure required to achieve a given density.





1. SERIES of printing rolls are arranged as shown in schematic drawing, ***lower left.***

2. BEARING CAP castings, ***right,*** sometimes support printing rollers weighing 500 lbs.

3. CORRUGATED cardboard for boxes runs through this machine, ***top left,*** to be printed and slotted.

Brass Permanent Mold Castings Cost 16% Less Than Sand Castings

By H. D. WARD, Chief Draftsman
F. X. Hooper Co., Inc.

IN the manufacture of corrugated paper boxes, the individual sheet of corrugated stock that will ultimately become a box is fed through a machine known to the trade as a printer slotter. In this machine, all of the printing that appears on the outside of the box is performed and the necessary slots cut in the sheet so that the box can be folded properly for assembly.

In the printer slotters manufactured by the F. X. Hooper Co., Inc. of Glenarm, Md., the ink distribution system for the printing rolls is a series of rolls arranged as shown in the schematic drawing in Figure 1 for a two color Printer-Slotter.

Two parts that required special design consideration are the roller sockets and caps, Figure 2, which are retaining members for the bearings of the ink rollers and must be made so that the rolls can be lifted out for cleaning.

The rolls are heavy — up to 500 lbs. apiece — and when they are removed it is not unusual

Continued next page

for the operators to use the bearing caps as temporary supports. Very often little care is used in the handling so that the cap members and the hinge are subject to a considerable shock load when the roll is dropped onto the open cap.

This same shock loading can occur, of course, when the roll is replaced in the socket. Of necessity then, the parts must be made extremely rugged.

Originally the socket and cap were designed as sand castings in so-called Hytensil bronze, an aluminum bronze containing 23 percent aluminum and about 3 percent each of iron and manganese. Physically, the parts made from this alloy were highly satisfactory, but both surface finish and accuracy were such that too much machining had to be done on the castings.

When redesign was studied in an attempt to lower manufacturing costs, it became apparent that these sockets and caps could economically be made as permanent mold castings. Since up to 16 pairs of castings are used per machine, the initial tooling costs, which are somewhat higher than for sand castings, could be amortized in a relatively short time.

Further, permanent mold castings need very little machining to finish.

Good Physical Properties

The material selected for the casting is, again, an aluminum bronze containing about 10 percent aluminum and 1 to 1.5 percent iron. This alloy is hardenable by solution heat treatment and as quenched and aged, has almost as good physical properties as the original material. The comparative properties of the two alloys are given in Table I.

While the alloy now being used is not quite as strong as the Hytensil previously used, it is entirely adequate for the service. Further, because of the higher rate of cooling, the permanent mold casting exhibits a finer grain structure and appear to have better impact properties.

In contrast to the older sand casting that required major machining to make it ready for installation, these permanent mold castings are almost ready for use as received from the Pressco Casting & Mfg. Co. foundry.

Comparison of the drawings for the finished assembly, Figure 4, shows graphically how the amount of machining has been reduced. Where formerly thirteen faces required finish machining, the bore for the bearing had to be finished, and pivot holes required boring; the total machining is to bore the pivot holes and tap one mounting hole.

This saving in machining has resulted in a cost reduction of 16.5 percent on the finished part in spite of a somewhat higher per piece cost in the as-cast condition.

4. HERE ARE REASONS why brass permanent mold castings have taken the place of sand castings for the two bearing cap castings:

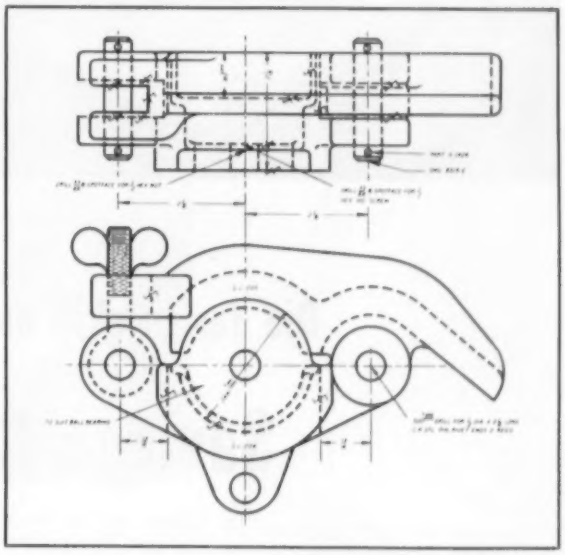
Satisfactory Physicals:

TABLE I
Comparison of Physical Properties

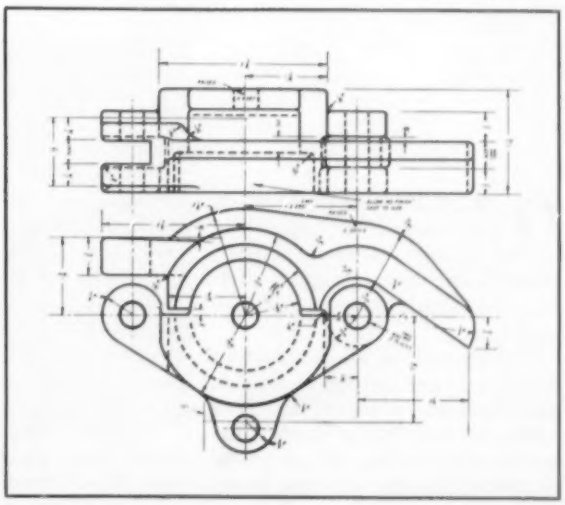
Alloy	Tensile str., psi	Yield str., psi	Elong. %	Hardness
Hytensil	110,000	65,000	15	220 Brin.
Alum. bronze as-cast	80,000	36.000	17-26	75-85 Rock B

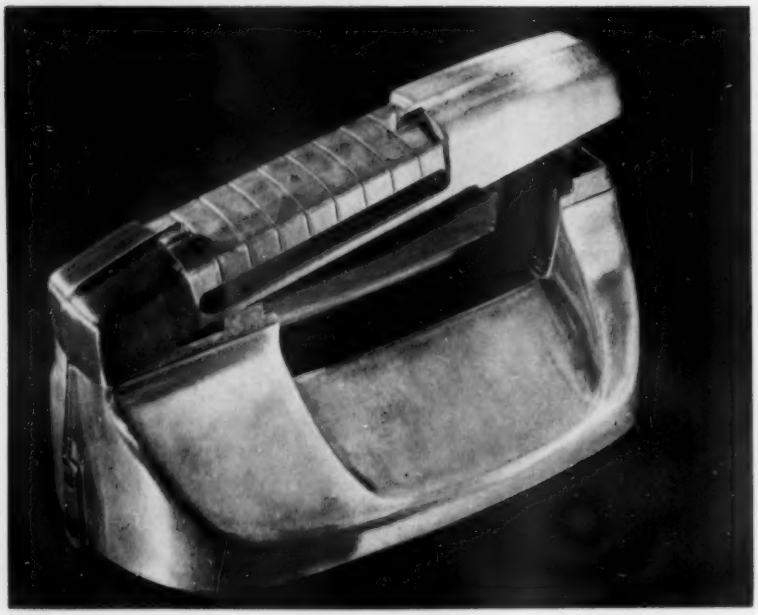
(Data for Hytensil from **Metal Data**, Samuel L. Hoyt, 2d edit., Dec. '52).

Less Machining Required:



Permanent Mold ▲ Sand Cast ▼





1. MORE PARTS of today's washing machines are redesigned from stamping to die casting because . . .

2. IMPROVED STYLING, better detail and more rigid construction can be obtained with die castings, such as these produced by Madisen-Kipp Corp.

Die design skill on these washer parts produced

Savings Right From The Die

. . . for example →

OF major interest to the product designer is the ability of die casters to make larger, thinner and more complex castings in aluminum, magnesium and zinc.

Improvements in die casting machines have helped make this size increase possible, as have improvements in die steels. Superior die casting alloys make possible sounder, stronger parts and back of it all there has been the constant impetus of higher and higher labor costs.

Because of the higher labor costs, design and production men have to look for methods of fabrication that will cut both the number and the complexity of shop operations.

Modern design has had its effect also. Public demand for well-styled products cannot always be satisfied with the older methods of fabrication. Were it not for die casting, the desired appearance often could not be achieved.

In spite of these trends that favor the use of large, complex die castings, there still remains the problem of designing the dies in which the castings can be made.

The die designer working with

both the product designer and the die caster is perhaps the key to successful production.

On the shoulders of the die designer rests the responsibility of developing die casting dies that will give the required product with as few engineering changes as possible.

The complexity of his problem can well be illustrated by examining two large die castings being used by the Thor Corp. as washing machine wringer housing members, Figures 1-4.

In many cases where the design of a part is relatively complex, the end product is a compromise between what is most desirable and what can be done. In this case, however, it was up to the die designer to produce tools that would make the part as initially designed without compromise.

Some of the most serious problems came in the larger of the two castings, the shroud. The over-all dimensions of this piece are 21" x 12¼" x 7¼" with an average wall thickness of ⅛" and a trimmed weight of 7½ pounds. Regardless of how the piece is gated, there is a long metal flow through thin channels which, particularly with aluminum as in this case, can lead to severe troubles such as cold shuts and imperfect filling.

Another prime difficulty is that, in several places, a relatively heavy section must be fed from a thin section, a condition which can lead to incomplete filling of the cavity and subsequent rejects.

In at least two places, it was essential to place core pins in juxtaposition to ejector pins. If nothing else, this makes for expensive die making and maintenance.

Finally, there is the matter of undercuts which prevent a straight core pull. The shroud shown in Figure 3 has, at the left end, several support members. These are shown in some detail in Figure 4. Necessary offsets and clearances precluded the inclusion of a solid member while the slot would be a difficult machining job if it could not be cast in. To form this portion, the die designer makes use of a separate core section which,

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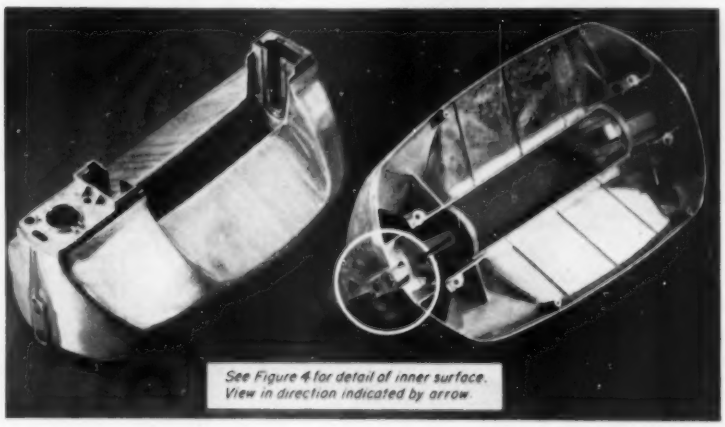
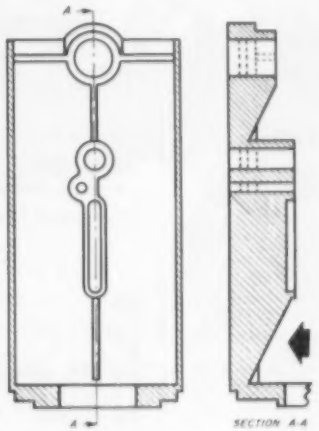
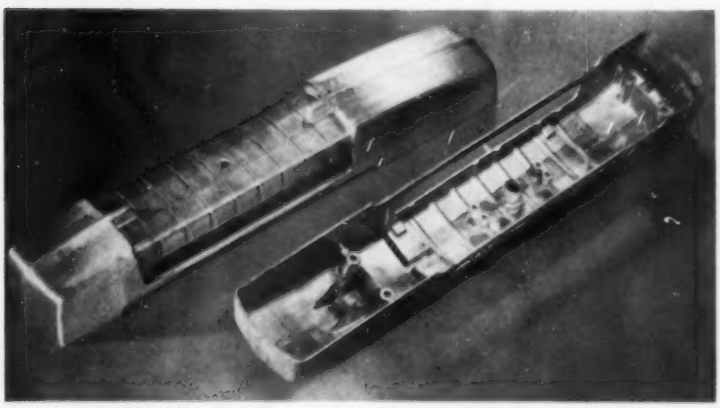


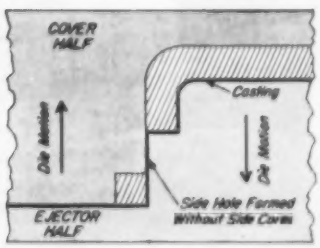
3. INTERNAL UNDERCUTS, while not recommended in die cast design, can be accomplished very often with loose pieces in the die called "knockout cores" (arrow).



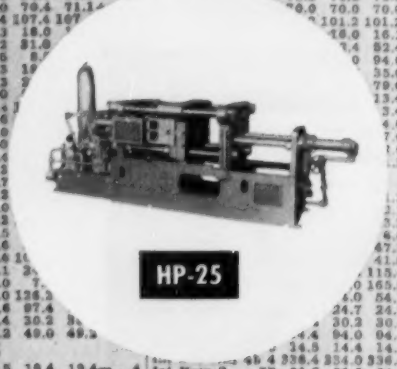
4. SECTION VIEW indicates undercut portions formed by loose cores.



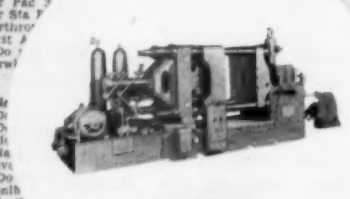
5. SIDE OPENINGS in the casting can be formed without slides or special coring, thus saving on tooling costs.



6. OVERLAPPING cover and ejector halves of the die produce the side slot.

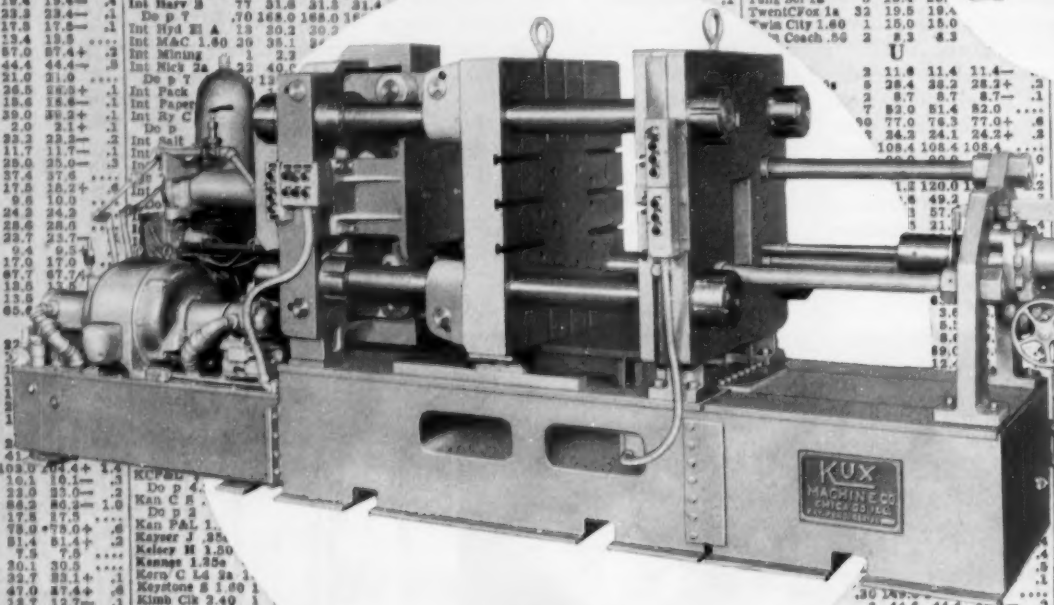


HP-25



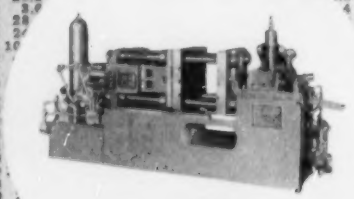
BH-40

HP-22

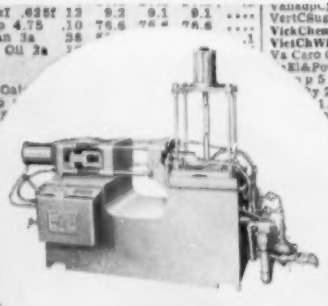


HP-37

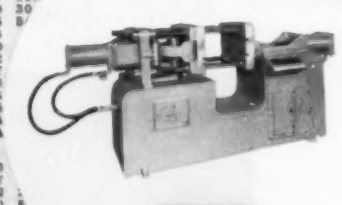
Hydraulically operated cold chamber machine. 600-ton pressure. Die space between bars 26½ x 20½. Die separates 18".



BH-18



K-5



BA-14

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Blue chip users of

KUX die casting machines

...our stock in trade

There are excellent reasons why so many famous companies prefer KUX Die Casting Machines with their built-in points of superiority. KUX machines, year-in-year-out with minimum maintenance cost, produce castings having unexcelled structural density and hardware quality finishes.

Whatever your die casting production problem, there is a KUX machine to fit your needs . . . whether it's for huge castings weighing 35 pounds or more . . . or for tiny hard-to-cast parts in any of the alloys of zinc, aluminum, magnesium, brass, tin or lead.

Every KUX model reflects the skill and knowledge gained in 35 years of serving as a leader in the development of die casting as an industry. This long association has enabled KUX to engineer machine design superiorities in its full range of models, a few of which are described and illustrated here.

HP-25 Hydraulic cold chamber machine for aluminum, brass or magnesium castings. 400-ton pressure.

BH-40 World's largest standard plunger goose neck machine. 800-ton die locking pressure.

HP-22 Vertical type cold chamber for production of parts having cast-in inserts. 400-ton pressure.

BH-18 Plunger goose neck type with self-contained melting pot and furnace. 400-ton pressure.

K-5 Air operated for smaller castings at very rapid speed of production. 25-ton pressure.

BA-14 Air operated cold chamber machine using moderate injection pressure for brass, aluminum or magnesium. 80-ton locking pressure.

KUX Machine Company

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INVESTMENT CASTINGS

Textile Machine Builders Use Investment Castings

The use of investment castings by The Reece Corporation, leading producer of industrial buttonhole sewing machines, is another example of the growing application of investment castings in sewing and textile machines.

What are some general requirtments of sewing machine parts?

1. **They must operate at high speeds.**
2. **Many are subject to high stresses and high impact loads.**
3. **The surafces of thread handling parts, usually a series of compound curves difficult to finish, must be extremely smooth.**

FOUR investment castings being used by The Reece Corporation are shown below. Two designs of clamp feet are shown at "a" and "b", a throat plate "c", a cam "d" and a sewing hook "e". Each one of these parts will be examined separately and the reasons for the use of investment casting developed.

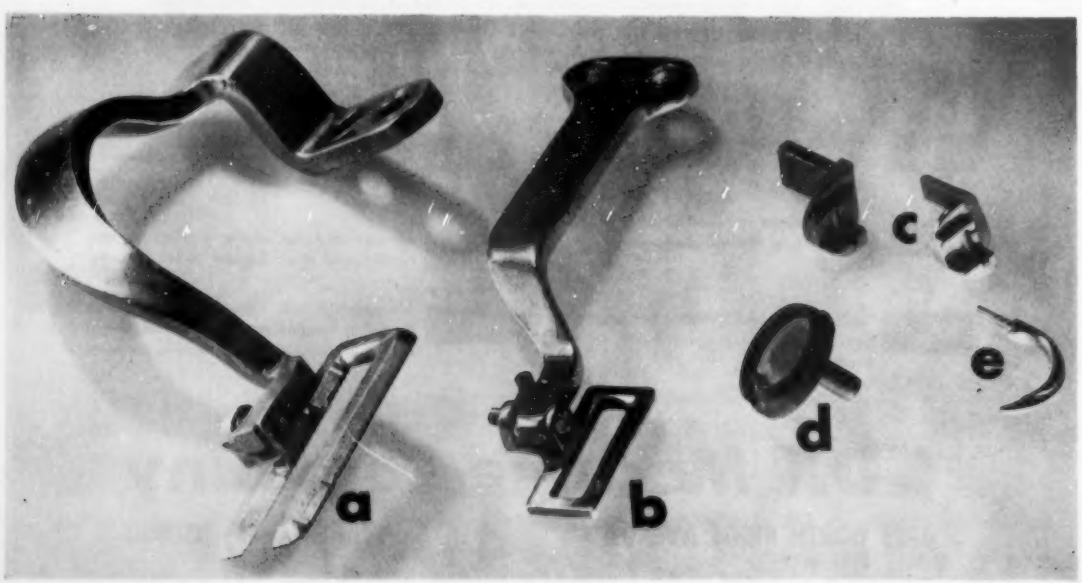
Both the required physical properties and the most desirable design functions dictated the choice of investment casting as the method of making the clamp feet.

To combat both wear and impact, the clamp foot must be hard and non-brittle. These requirements at once eliminated cast iron and the die-castable alloys. The most obvious material then seemed to be a good grade of hardenable steel, case carburized to give a hard surface for wear resistance and a tough core for impact resistance. Machining the part from solid stock would have been extremely expensive, and sand casting was ruled out since the thin sections could not accurately be held.

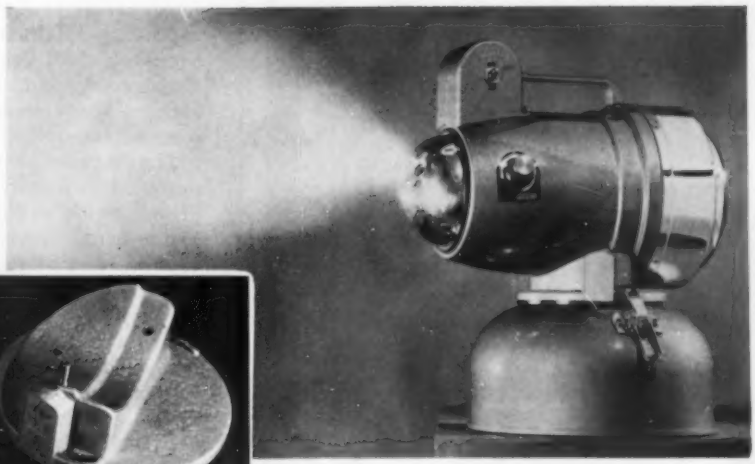
Investment casting meets all requirements of function and economy, and as cast by Arwood Precision Casting Co. in SAE 3120 steel, needs only to have a pivot hole drilled prior to carburizing, case hardening and polishing. The finished piece has a surface hardness of 60-62 Rockwell C.

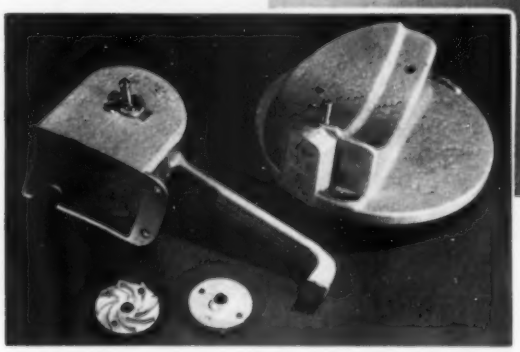
The throat plate shown is also investment cast in SAE 3120. This part has a limited application which would not justify expensive tooling and machining from bar stock for the quantities involved. In this case, however, more machining is required after casting than on the clamp feet. Since the shank must fit a dove-tail slot with only 0.001 tolerance, this degree of precision is not attempted by the foundry. Carburizing, case hardening to 60-62 Rockwell C and polishing are the final operations.

Continued on page 91



A BETTER LOOKING product at lower cost is achieved by using die cast zinc components.





"Plus" Values Of Die Castings . . .

FOR large enclosed areas where the insect population must be kept down to a minimum, some sort of water-borne insecticide is customarily used. To be effective, the size of the individual insecticide droplets must be maintained within rather narrow limits: if the droplets are too large, they will settle out rapidly, while if too small, their effective killing power is reduced.

Some sort of mechanical device is required to produce the proper mist. Such a sprayer must also be simple to handle and operate and inexpensive so that the use of insecticides is not deterred because of the high cost of dispensing equipment.

One device for producing an insecticide fog is the sprayer, illustrated, manufactured by Z & W Machine Products, Inc. of Cleveland, Ohio. Three of the parts which would be extremely costly to make by machining from stock or machining sand castings are made as zinc die castings by the Superior Die Casting Co.

The three castings used on the sprayer are shown above left. While these appear to be simple, there are some design features that only die casting could accomplish. In the combined switch housing and handle it is notable that the thin walled housing joins a heavy section forming the unit handle. Under any casting conditions, such a junction is subject to cracking during cooling. By proper design of the fillets and proper feeding, this casting is made with the junction completely sound so that failure never occurs.

In order to fit the steel housing, the radius of curvature of the two ends of the switch box must be different. By machining this would be a costly operation, but as a die casting different curvatures are formed as simply as if they were the same.

Other features of this part that are less costly as a die casting are the raised lettering that is clear and easily read, and the contoured recess for the switch plate. Neither of these could be secured with the precision and detail shown by any other manufacturing process.

The plate which serves as a combined mounting for the motor and atomizing unit as well as a cover plate for the liquid tank is another excellent example of the die casting art. Here thin sections, carefully ribbed to give the needed

Continued on next page

strength are used in combination with the heavier cover plate section that gives the necessary rigidity and flatness to seal, in combination with a gasket, the liquid tank. The small brass tube that conveys liquid from the tank to the atomizer is a screw machine part that is pressed into a cored hole.

The impeller, a third die casting, is specially designed to impart a spinning action to the fog of insecticide as it leaves the machine. Contrary to the usual impeller action, this one is stationary. A jet of air passing through the center hole draws liquid and air around the periphery of the impeller and the shape of the blades gives it a spinning motion. At the center it mixes with the jet and is blown out into the room, still spinning so that the desired angle of distribution is attained.

Not only is the design of this part one that would be difficult to sand cast, but smoothness of surface of the vanes is essential to reduce skin friction. To machine it from stock or from a sand casting would be highly uneconomical, but as a die casting it can be used as cast and trimmed, without secondary work.

Surface finishing is simple on these castings. A baked hammer finish is used so that only light sanding is required prior to painting and baking.

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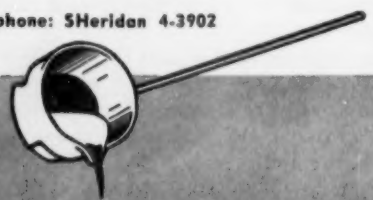

ALUMINUM CASTING and ENGINEERING COMPANY

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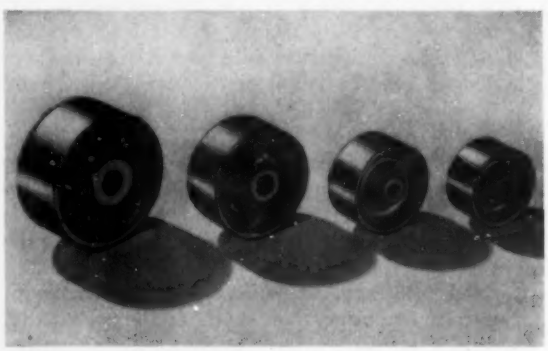

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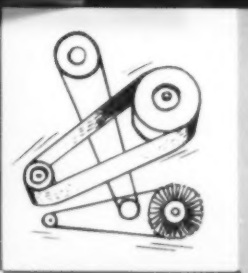

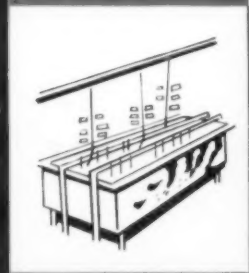

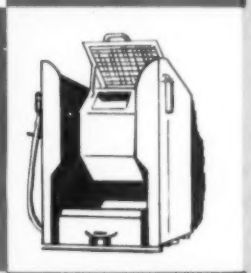

PMM

Finishing Section

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

devoted to the specialized problems of finishing . . .

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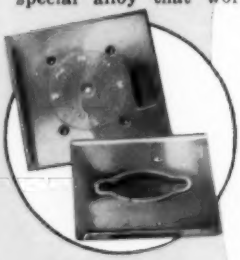
The machine above is equipped to paint and wipe 5 colors.

ROTO-SPRAYER paints up to 1200 parts per hour. Operator loads the part, touches the foot valve— and the machine does the rest. The part spins, guns go on, then off, rotation stops Oscillating gun reaches the hard places. A complete painting machine including booth, fan, guns, pressure tank.

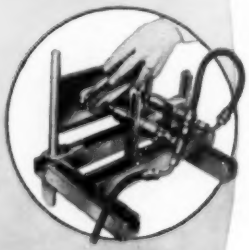
MODEL 4500 PAINTING MACHINE, paints small parts; mask holder is adjustable to take masks up to 12 x 12 in. In operation, foot pedal is pressed, an air operated hold-down pushes the part into mask— and the part is painted by an oscillating spray gun. The machine paints as fast as the operator can load parts.

AUTOMATIC PAINT WIPER cuts 65% to 85% off the cost of wiping parts— it's 3 to 8 times faster than hand methods. Wiping is done by a continuous roll towel, which may be laundered and reused. The operator loads, presses pedal, and the machine does a perfect wiping job, either rotating or oscillating the part as the towel wipes it. It makes the biggest savings on really tough wiping jobs.

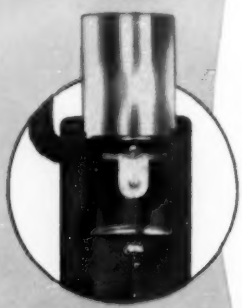
PRESSURE-FORMED SPRAY MASKS, made from special alloy that work-hardens to 113,000 psi tensile strength. Stronger and thinner for easier, faster spraying. Quicker cleaning of masks— and lower cost for mask maintenance. They cost you no more than the old-type masks, and delivery is fast.



MULTIFIT SPRAY MASK CLAMP holds the mask and part in position while spraying— assures accurate painting, reduces rejects. Each Multifit clamp is quickly adjustable to a wide variety of parts and masks— is used over and over on various jobs, saving the cost of special fixtures. 3 standard sizes.



FIN-E-CO MASK WASHER. Each operator quickly cleans masks whenever needed, for smoothest production. Masks are submerged in solvent during the cleaning, then "pop-up" to dry after a timed cycle. Door opens and closes automatically.



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Here Is The First Full Report on

A New Method of Protecting Magnesium

- **Properties**
- **Surface Preparation**
- **Application Methods**
- **Equipment**
- **Testing**
- **Galvanic Corrosion**
- **Applications**

By R. STRICKLEN, Development Engineer,
Allied Research Products, Inc.

DUE to its position in the electromotive series, magnesium is a very active metal. Fortunately, while its oxide film is not completely self-healing, many of its reactions produce surface films which tend to retard further attack. This characteristic enables designers to take advantage of its lightness in structural applications. The mechanical properties of magnesium are improved by alloying with small amounts of aluminum, manganese, zinc, and zirconium. Additions of these metals, however, tend to increase the corrosion rate of the magnesium in many environments.

The art of protecting magnesium alloys from corrosion by chemical and electro-chemical means, dates from the early 1920's. Bleiweis and Fusco[1] have summarized the progress

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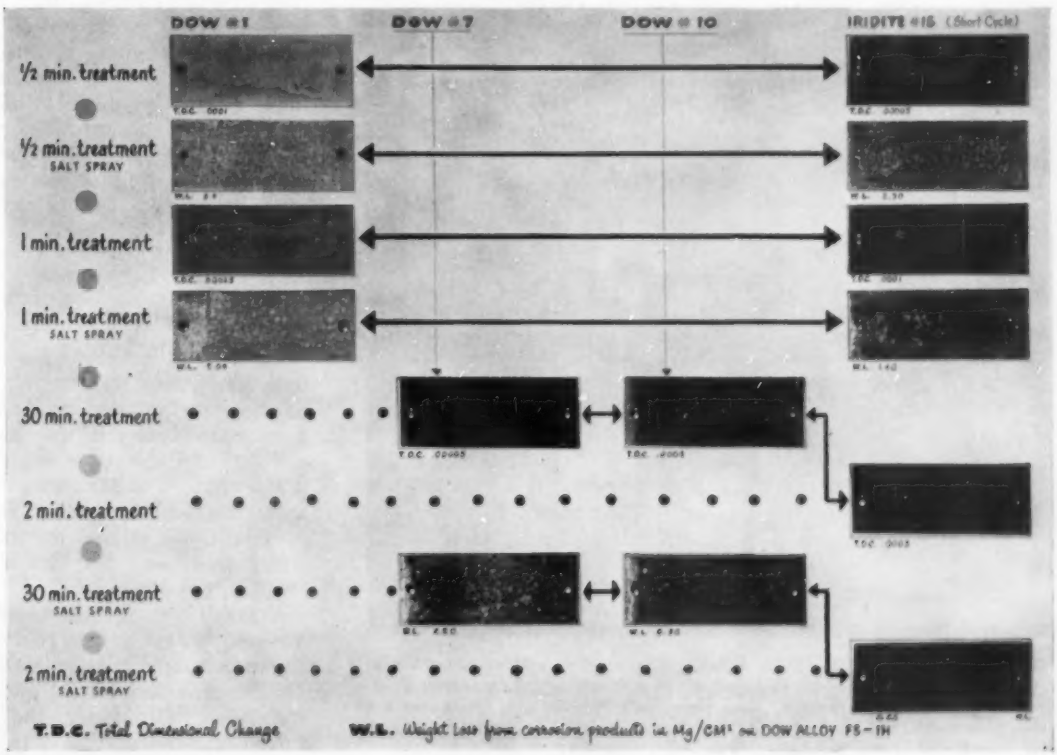
I. COMPARISON CHART of four treatments . . .


DOW #1
DOW #7
DOW #10
IRIDITE #15 (Short Cycle)
½ min. treatment
½ min. treatment SALT SPRAY
1 min. treatment
1 min. treatment SALT SPRAY
30 min. treatment
2 min. treatment
30 min. treatment SALT SPRAY
2 min. treatment SALT SPRAY
T.D.C. Total Dimensional Change
W.L. Weight Loss from corrosion products in Mg/CM² on DOW ALLOY FS-1H

Chromate Film Does Not Flake, Spall Or Become Embrittled

Protecting Magnesium—Cont.

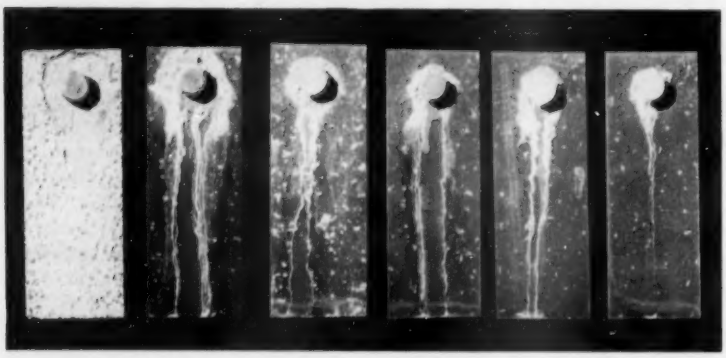
up to 1945. Diggin[2] has outlined the methods that are applied widely at present.

Most of the treatments in use fall into one of two classes. Chemical processes consist mainly of acid chromate treatments. The anodic processes are mostly alkaline and form hydroxide and carbonate films. For providing paint bonds and similar work, the chemical processes are generally the most economical.

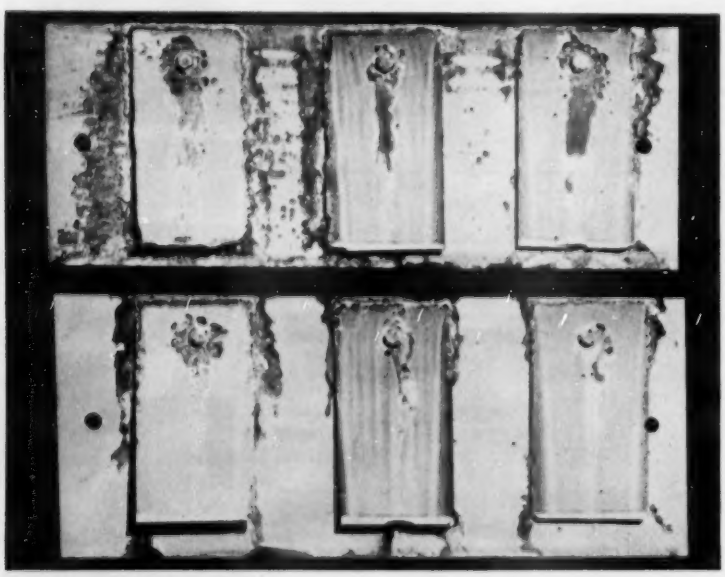
The alkaline surfaces produced by most of the anodic treatments, while they are hard and wear resistant, must be modified by subsequent acid treatment if a paint bond is desired. An exception reported is Dow Chemical Company's new anodic process, Dow #17. This has been described by Barbian[3] as using an acid electrolyte which does not require subsequent film modification.

Close parallels may be drawn between the finishing of magnesium and other structural metals. The most protective of the established chemical treatments require temperature ranges from 180°F. upward, and immersion times from 30 to 45 minutes. The anodic processes introduce individual handling and racking of the work pieces, together with occasional problems in current distribution on the work. The need for ventilation is common to both the chemical and electrochemical processes.

The metal finishing requirements of military work during World War II sparked the development of a series of proprietary chromate conversion treatments for zinc and cadmium. The salient features of these treatments are high protection obtained with short treatment time, at room temperature, in low cost equipment. Allied Research Products, Inc. pioneered in this work and subsequently extended the finishes to cuprous alloys and to aluminum. More recently, development work on magnesium has produced commercially a chromate conversion coating for this metal called Iridite #15 (Mag-Cote).



2. GALVANIC CORROSION TESTS. (l to r) Panel 1, no treatment; all others Iridite #15. Bolts used are 1, plain steel; 2, plain steel; 3, zinc plate; 4, zinc plate; 5 cadmium plate; 6, cadmium plate, Iridite #1.



3. GALVANIC CORROSION TESTS. Panels, (l to r) FS-1 magnesium untreated; FS-1 magnesium with dichromate; FS-1 magnesium with Iridite #15. Mounting strips, (top) 75S-T bare aluminum; (bottom) 75S-T aluminum with Iridite #14; Rivets used are 17S aluminum treated with Iridite #14. All panels were punched before treatment and painted with 1 coat of zinc chromate primer before assembly.

General Properties

As with other chromate surface conversion treatments, the film is a precipitated product of a reaction between the metal and an acid chromate solution. It is a mixture of hexavalent and basic trivalent chromium compounds. Some salts of the metal under treatment are also combined in the structure.

A small amount of metal is removed during the reaction. The dimensional change is about .00015 per surface for a 1 minute immersion. Ordinarily, the required immersion time is 15 - 30

seconds, giving a loss of less than .0001 per surface. These figures were obtained on FS-1 sheet stock. Other alloys will vary slightly.

The coating is somewhat softer than other coatings formed at high temperatures, such as in the dichromate process. Consequently, no flaking or spalling is observed on any deformation of the metal. No embrittlement occurs, such as with anodic films, on thin cross sections. The structure of the coating varies from that usually associated with chromate conversion coatings.

The color varies from dark to light brown, becoming lighter as the aluminum content of the magnesium alloy increases. Generally sand and die castings take on a lighter color than sheet stock. Uneven appearance on die castings does not necessarily indicate uneven protection, but is more likely due to surface imperfection in the casting.

Surface Preparation

No chemical or electrochemical finishing process has been shown to produce its best results, economically or functionally, on anything other than a thoroughly clean surface. The steps used on other metals apply equally to magnesium.

Mechanical cleaning is feasible under limited conditions. For example, freshly machined surfaces which have no oils present may be treated without chemical cleaning. Wire brushing with stainless steel brushes has been used, and also sanding with aluminum oxide grits. Steel wool and ordinary wire brushes tend to imbed iron particles in the surface, which are detrimental to corrosion resistance.

Sand, shot, or grit blasting, and any other method which imbeds foreign particles in the metal, must always be followed by pickling if maximum corrosion resistance is required.[4] Other mechanical operations such as grinding, polishing, and buffing are used prior to chemical finishes or electroplating. Chemical cleaning is necessary in most of these cases.[2]

Here Are Some Of The Current Uses For These Protective Coatings

1. *Electronics* — Iridite is the first magnesium surface treatment to combine a high degree of protection with low electrical resistance. Because the applications are on classified material for the Armed Services, quantitative data are not available at present. However, it is possible to make grounding connections between components without removing the coating. These connections are sufficiently conductive to eliminate radio frequency interference. The use of the MIL-M-3171 Type III Dichromate Process in such an application results in a prohibitively high noise level. Aerial reconnaissance equipment and airborne radar are typical applications. The parts treated are sand castings and die castings.

2. *Optical Instruments*—The non-reflective character of the Iridite #15 surface when dried in hot air, together with the darkening of the color at 300F. has resulted in its use in certain optical equipment. In this case, the metal used was the FS-1 sheet which gives a dark brown color. Hot drying produced a nearly black surface. This surface is non-reflective while the conventional black treatments are usually glossy.

3. *Paint Base* — A manufacturer of recording equipment has shortened the elapsed processing time on die cast magnesium housings by 75 per cent. Considerably increased production is possible in the same size equipment as that used for the dichromate process.

4. *Preparation for Structural Adhesives* — An aircraft manufacturer compared Iridite #15 with the dichromate process in the bonding of rubber electrical de-icer elements to magnesium. The magnesium was treated, and the rubber washed with toluol. Each was given a coat of primer and a coat of adhesive which were allowed to dry 30 and 20 minutes respectively. The curing, aging, resulting bond strength, and predominant type of failure are shown in Table 1.

Oils and greases are partly removed by pre-cleaning where necessary. Conventional solvent, solvent emulsion, and solvent vapor are used. Surfaces are cleaned free from water breaks with alkali soak or electrolytic cleaners. The heavy duty types used on steel, with a pH of 11.0 or higher, are recommended.

Pickling of magnesium may be divided into pre-pickling and process pickling. Pre-pickling is used to remove .0005 per surface from sheet stock to eliminate rolled in mill scale and heavy metal particles. A thickness of .002 per surface should be removed from castings which have been sand, grit, or shot blasted. If the finishing process removes enough metal to release the inclusions, as is said to be the case with Dow #17, pre-pickling is not necessary.

Process pickling is the step which follows alkali cleaning in the treating cycle, and serves to remove light oxides as well as any alkali from the cleaner which was not removed in the

Continued next page

rinse. Two pickles have been selected for use with the Iridite #15 process.

The choice was based on obtaining maximum salt spray protection. A chromic acid - sodium nitrate pickle is used on sheet stock. For die and sand castings a chromic acid-nitric acid-hydrofluoric acid mixture is recommended.(4)

An immersion of a few seconds is sufficient for process pickling on work that has been prepickled at the mill. Longer immersion will remove a considerable amount of impurities if necessary.

Thorough rinsing after cleaning and after pickling is an essential part of the preparation of the surface.

Method of Application

The treating solution is prepared by dissolving Iridite #15 powder at the rate of 5 oz/gallon and adding 7½ fluid oz/gallon of 20°Be' hydrochloric acid. Addition of 1 ml. of a wetting agent, ARP #2, per gallon completes the solution. This wetting agent is one which is formulated for a high degree of stability in acid chromate solutions.

Operation is at room temperature, 70 to 95F. Immersion time is normally 15 to 30 seconds.

The work is then cold rinsed and dried by any convenient methods. Hot rinsing is not used since it causes excessive softening of the film. Drying temperatures in excess of 160F. reduce the solubility of the coating. Unlike other chromate conversion coatings, however, high drying temperatures do not noticeably decrease the salt spray resistance. Along with the other effects of high temperature, the color of the film is darkened. The normal color is light to dark brown. The darker shades occur on the low aluminum alloys such as FS-1. At 300F the coatings on all alloys are darkened, the FS-1 alloy becoming nearly black.

The solution described above is effective on most alloys. Slight variations in the case of some alloys give improved results. For example, M alloy is treated by adjusting the pH of the solution to a range of 1.2 to 1.6 with a small addition of sodium hydroxide. This is a little above the normal range of 0.2 to 0.6. The zinc-zirconium alloys like ZK-60 give best results when the hydrochloric acid is reduced to 1 fluid oz/gallon.

The control of the solution is simple. The pH is checked electrometrically and adjusted as necessary by additions of Iridite #15 and hydrochloric acid in the same proportions used in solution preparation.

Equipment

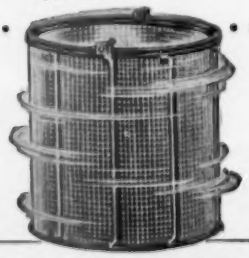
Tanks for containing the solution should be lined with acid-resisting vinyls such as Koroseal, Tygon, etc., or made from rigid plastics such as Lucoflex, Boltaron, Lucite, or Plexiglas. Stainless steel is not satisfactory because of the high chloride content of the solution. Heating is no generally required since the operating range is around room temperature. Where necessary, silica jacketed immersion heaters or tantalum coils may be used.

Ventilation is not required since the wetting agent used produces a light foam blanket. This

PAYS FOR ITSELF... *IN TIME SAVED*

Kreider Dryer with auxiliary steam heating unit (illustrated). Auxiliary natural gas heating unit available; also standard model without auxiliary heating.

Basket (below). Heavy gauge woven steel mesh over steel frame. Capacity, 1140 cu. ins.



Spin-Dries* up to 50 pounds in less than 2 minutes

Saves drying time. Kreider Dryer operates on ¾ h.p. at 625 r.p.m. . . . cuts drying time to as little as 35 secs.—no more than 2 mins.—for each 50 lbs.

Saves production time. Runs at top speed with maximum load, hour after hour, day after day. Ends drying "bottle necks". . . assures smooth, evenly dried surfaces, longer lasting lustre—fewer "rejects."

Saves maintenance time. Simple, sturdy construction reduces "time-outs" for repairs and servicing to a minimum. Assures long life.

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New Holland Machine Co., New Holland, Pa.

***Only 2 simple steps required...**

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON."

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

NEW HOLLAND *KREIDER* DRYER

Circle No. 82 on Reader Service Card

Metal Treatment		Pressure Cure Only		Heat and Pressure Cure	
	AGING TIME DAYS	AVER. BOND STR. IN SHEAR P.S.I.	PREDOMINANT TYPE OF FAILURE	AVER. BOND STR. IN SHEAR P.S.I.	PREDOMINANT TYPE OF FAILURE
Dichromate Process	1	262	Primer pulled off plate	320	Primer pulled off plate
	3	283	Primer pulled off plate	377	Primer pulled off plate
	56	446	Primer pulled off plate	514	Primer pulled off plate
Iridite #15 Process	1	413	Cement pulled off rubber	533	Rubber Failure
	3	530	Primer split	601	Rubber Failure
	56	708	Rubber failure & Primer split	718	Rubber Failure

Table I

is effective in suppressing any spray from the normal slight gas evolution.

Testing

Early in the development program, the use of salt spray alone for comparing the corrosion resistance of specimens was found to be unsatisfactory. For example, two panels might have the same percentage of surface area attacked by the salt spray. On removal of the corrosion products and the remaining protective film an entirely different picture may be presented. The attack on one panel could be superficial while that on the other consists of deep pits which nearly perforate the metal.

Obviously, something better is needed in the field of accelerated corrosion testing for magnesium. This is borne out by the fact that the Air Research and Development Command has placed several contracts with commercial laboratories for the development of an adequate performance test for evaluation and inspection of protective finishes on magnesium. At least one of these contracts is now in effect. To date, there has been no announcement of an acceptable test. The existing specification is a process specification only, as discussed below.

Since the main aim of corrosion protection is to prevent deterioration of mechanical properties, it was felt that combining an elongation test with salt spray exposure of unpainted panels would give a good comparison of chemical surface treatments. However, it has been demonstrated repeatedly that wide variation is possible even in salt spray equipment operated in full accordance with Federal Specification QQ-M-151. Consequently, no quantitative results would be obtainable. A qualitative comparison could be obtained for a given set of panels in a single run in a salt spray cabinet and if suitable controls are used this might be instructive.

In applying an elongation test, a prohibitive number of specimens would be encountered in a development program. As a substitute, determinations of weight loss from salt spray attack were used to determine the degree of overall protection. This was supplemented by examination of the panels to determine the type of attack. Since distributed superficial attack is considered to be less detrimental than deep pitting, all treatments showing deep pits were rejected.

Due to the variations of the salt spray test, the results cannot be called quantitative. However, the comparative results agreed closely from one test to another. A typical comparison on FS-1 alloy sheet is shown in Figure 1.

A property of equal importance with salt spray resistance is paint bonding. Painted panels have been tested up to 2000 hours in salt spray. The surface treatments used were Iridite #15 and the dichromate treatment. All panels were given two coats of MIL-P-6889, a primer and two coats AN-L-29, a lacquer. Little blistering occurred on any of the panels. The degree of corrosion was similar on the two surface treatments and the paint adhesion was not affected.

Water fog tests of unpainted panels tend to emphasize the unique structure of the Iridite #15 coating and its ability to minimize pit type corrosion. For example, in a test running 850 hours, the Iridite showed general light superficial deposits of white salts while dichromate treated panels had localized attack areas which extended deeper into the metal. Adhesion of paint (primer and lacquer as above) was the same for the two treatments.

Continued on page 82

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Better for metal where a thread cutting action supercedes thread forming. Type "1" Central Thread Cutting Screws drive with minimum torque to form a perfectly mated thread and a tight fit. Interchangeable with standard machine screws.

TYPE "23" THREAD CUTTING

Note the wide thread cutting slot that works better in softer metals such as aluminum and zinc, or in harder metals where the wide slot affords better cutting advantages.

TYPE "25" THREAD CUTTING

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Pointed and augur-like, the Central Type "A" Tapping screw pulls and forms thinner (.015" to .050") sheets of metal into a matching threaded section from punched, drilled, or nested holes. Available with slotted, Phillips, clutch or hexagon heads.

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Recommended for general use in metals from .030" to .100" thickness. Standard pitch thread interchangeable with standard machine screws. Ideal for chip-free assemblies. Second assemblies can be made on projected end of the screw.

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FLASH REMOVAL is one of the wasteful but essential jobs to be performed on every die casting. Peripheral flash comes off easy enough with a trim die, but what about other flash around cores, slides, ejectors, etc.? Here's an economical way of bulk flash removal without hand operations.

Automatic, Bulk Flash Removal On Die Castings

AIRLESS BLASTING machine, above, has just completed 10-minute cycle to remove flash and burrs from 40 aluminum electric sander die castings. Much hand work is avoided by this procedure.

By EUGENE F. ANDERSON, Special Engineer, American Wheelabrator & Equipment Corp.

A SWITCH from manual to automatic work methods is expected to speed operations and lower their cost, but many times, it results in unexpected benefits as well.

Such was the case with Racine Die Casting Co., Racine, Wisconsin, a job shop producing a wide variety of zinc and aluminum die castings. A switch to automatic deflashing and deburring of these resulted not only in important cost savings and higher cleaning rates, but a vast improvement in quality control, with regard to paint adherence and elimination of porosity. Castings to which paint would not adhere or which would leak when holding liquids can now be culled out and rejected by visual inspection.

The plant had used for a long time the conventional manual methods of punch presses, scraping, and filing, but as production increased, these methods were too slow to keep up, and the deflashing department started to become a plant bottleneck.

In an effort to remedy the situation, plant officials investigated various automatic methods. Airless abrasive blasting, which has wide application in this work, came to their attention. It seemed most adaptable to their conditions, so it was adopted. Since the parts under consideration were of a size and structure that would withstand a gentle tumbling action, a "Tumblast" machine manufactured by American Wheelabrator & Equipment Corp. was installed. The blasting compartment of this machine is characterized by a continuously moving, endless, apron-type belt conveyor, which moves through the blasting compartment in a path formed by the shape of the letter "J". It forms a "trough" at the bottom of the "J" for holding the die castings.

The motion of this belt gently turns the castings over and over under energetic blasts of metallic abrasive thrown centrifugally from a rotating wheel mounted in the cabinet roof. This combination assures that all areas of the castings receive the same amount of deflashing and deburring action, yet neither

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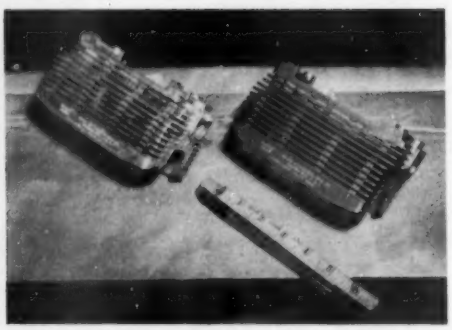
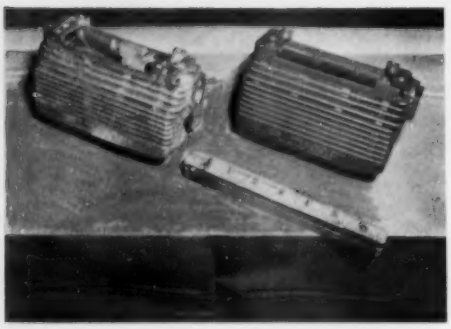
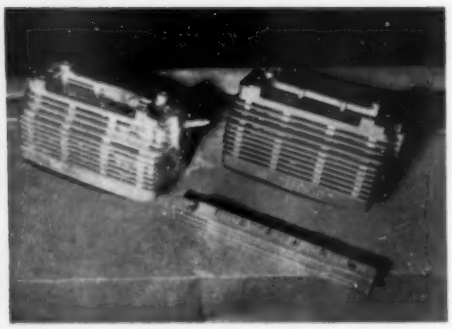
Ventilating Grilles Make Difficult Flash Removal . . .







THREE CLOSE-UPS of electric sander housings before and after airless blasting. At left in each view is casting as it comes from the die; at right, as deflashed. View at top left shows the de-flashing compartment with 40 sander housings still in it.

the action of the belt nor the blast of abrasive are severe enough to damage the parts. The abrasive used is a non-ferrous material so new that its name is merely "Abrasive X".

Typical Loads

The deflashing compartment of the machine has room to accommodate a two-cubic-foot volume of parts. Some typical loads presently are the following:

40 aluminum electric sander housings, sized 6" long, 3" wide, and 3" high;

150 zinc sewing machine motor housings, sized 3" long, 2½" wide, and 3" high;

350 zinc vibrator motor housings, sized 2" in diameter by 2" in height.

Many other castings are handled in the machine in various quantities per load, depending upon the size and nature of each part's construction.

A load of 40 electric sander housings is blasted 10 minutes. This gives a deflashing production of 200 per hour. The former method consisted of six different punching operations with a die, followed by manual filing for deburring at a rate of 50 per hour. Trimming with a die at a rate of 125 per hour followed. Filing is seldom needed on these parts any more, but if it is, it is done in the inspection department.

Two girls were transferred to other work, and the total finishing cost on this part has been reduced by an amount of $40.00 per 1000 castings.

One man operates the Wheelabrator now, but with the automatic method of exposing the parts to the blast, it is unnecessary for him to attend the machine during the cleaning cycle. He can be used for stock checking, tagging, etc.

Another time saving factor is the automatic unloading of the machine. A typical load of parts can be unloaded in seconds by merely reversing the direction of the conveyor belt, with the door of the machine opened, and the parts discharged from the blasting compartment into a tote box or other receptacle set in front of the machine.

With the sewing machine motor housings, the 150 parts in the deflashing chamber are given only a six-minute blast, in place of the manual scraping formerly done. Each load of 350 vibrator motor housings is given a 20-minute blast. To deflash these motor housings would be a very difficult hand scraping job without the mechanical blasting, because *it would be impossible to fit a trim die to the inside, where much of the deburring is necessary.* The cost of finishing these has been reduced 1½ to 2 cents per casting, or 20 percent.

Finishing cost for another part, a 3" x 3" x 3" jig saw motor housing, was reduced 30 percent.

Quality Control Expedited

Equally important is the quality control now possible. Practically all of the castings are subsequently painted in customers' shops. And many are used in various kinds of moving

machinery. Some castings, like the liquid soap dispenser, have to hold liquids.

Occasionally, laminations occur in the surface of the metal during casting, but are not always visible to the eye. This formerly caused complications, when some castings would be rejected after painting due to the paint flaking from these laminated areas.

This trouble has been eliminated by abrasive blast deflashing, since these laminations are shown up as "blisters" which form on the surface of the metal during blasting. The entire surface is of uniform color and character, so the blisters are apparent, and defective pieces can easily be culled out by visual inspection. The rejection rate due to paint failure has dropped to zero in all classes of castings produced here.

Since so many of the company's castings are parts for moving machinery, thorough deburring is given special attention. There must be no residual burrs to come loose and create a physical danger to an ultimate consumer after the part is put into use. If, for example, a motor housing for a hair dryer had residual burrs that became dislodged while the dryer was being operated, these could strike the user and cause injury that might result in legal difficulties. But the blast action is strong enough in this automatic deflashing process to remove zinc burrs and flash up to .005 thick and aluminum burrs and flash up to .010 thick, according to the plant operators. If any material is left inside the parts, it may be assumed that it is tightly attached and will not come loose later in service. Thicker flash on the outsides of parts is removed manually for appearance's sake.

Important as the heavier flash is, the fine wire burrs were formerly a bigger problem. They could not be efficiently removed, and so they made themselves nuisances to workers assembling the housings and other parts by cutting their hands.

LIQUID SOAP DISPENSER die castings are shown as cast (left) and after abrasive blast cleaning (right).

Indicates Porosity

With liquid soap containers, blast deflashing has made possible a reduction of 2 to 3 cents in cost of each casting by saving many man hours formerly needed to water test for porosity. The same laminations that cause paint adherence cause leakage.

Since the laminations were

Continued on page 82

it's the "FINISH" that counts

...and when it comes to finishing die castings, you can count on us

We make a specialty of plating zinc die castings on a production basis. We have completely automatic plating facilities suitable for long runs. We have more than 34 years of experience.

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Product Facts

Catalogs · Manuals · Brochures

PROCESSES

Machining, Powder Metal Parts: 144

A reprint of an article on how to machine powdered metal parts, how to grind tools for this work, etc. is available from the Amplex Mfg. Co.

Small Die Castings: 145

The Gries Reproducer Corp. has a number of pamphlets, reprints, and bulletins that describe and illustrate many of the applications of tiny zinc die castings, rivets, wing nuts, textile findings, etc.

Copper Base Castings: 146

Pressco Casting & Mfg. Corp. has a new booklet giving many applications of copper base castings as well as basic information on die casting, permanent mold casting and centrifugal casting.

Mechanized Shell Molding: 147

Modern trends in shell molding, both automatic and semi-automatic are discussed in the April issue of the Bakelite Review, published by the Bakelite Company.

Powdered Metal Parts: 148

Some of the different sintered metal parts currently being made by the Bassick Co. are illustrated and described in a leaflet recently issued.

Shell Molding: 149

An informative 28 page illustrated manual on shell molding demonstrating how this new casting process has reduced machining and finishing costs as well as foundry casting time has been announced by the General Electric Company.

How to Design Investment Castings: 150

Features included in a new booklet on designing investment castings are four pages of design principles and a two-page chart to help in selecting alloys. The booklet, published by Midwest Precision Castings Co., also has background information on the process and a number of interesting case histories.

To get copies of any item listed here, simply circle the appropriate number on Reader Service Card bound into this issue.

MATERIALS AND EQUIPMENT

Fabricating Aluminum: 154

The Kaiser Aluminum & Chemical Corp. has prepared a 272 page book on the forming and bending of Kaiser aluminum. This book is available free when requested on company letterheads; for personal libraries it costs $2.00.

Shell Molding Resin: 155

A group of loose leaf sheets describing shell molding resins and silicones for the shell molding foundry are available from the General Electric Co.

Temperature Control: 156

Revised and up-to-date information is now available on a new electronic temperature controller for high temperature applications. The unit is made by Cybertronic Corp. of America.

Pattern Buyers' Guide: 157

A new booklet has been issued by Master Pattern & Mold Co. to aid individuals not in the foundry business but who must purchase pattern equipment as a phase of product design or production engineering.

Thread Cutting Screws: 158

The Continental Screw Co. has issued a folder describing some of the thread cutting tap screws manufactured by that company.

Temperature Controlling: 159

Within the range of up to 1000F the Burling Instrument Co., Inc. offers a number of non-indicating temperature controllers. Their bulletin No. 103 describes these instruments.

Heat and Corrosion Resistant Castings: 160

The Alloy Casting Institute has just issued the first revision since 1951 of the A.C.I. standard designations and chemical composition ranges for heat and corrosion resistant castings.

Furnace Accessories: 161

Two new bulletins have been issued by Eclipse Fuel Engineering Co. on valves for combustion control and on air/gas proportional mixers.

Die Casting Machines: 162

Three sizes of European-made die casting machines are described in literature available from Barzantni International, Inc.

continued on page 71

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● CUT SHEETS fit your air or electric vibrating sander

● FOLD it like paper...TEAR it like cloth

NEW SAND SCREEN: Use both sides...do from 7 to 15 times the work!

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USE IT WET OR DRY...BY HAND OR MACHINE

Use SAND SCREEN the same way you use your present paper or cloth—wet or dry, by hand or machine. For hand sanding, full 9" x 11" sheets fold like paper, tear like cloth to any width you desire. Cut sheets fit your oscillating or vibrating sanders. Discs give best results when used wet with CARBORUNDUM's FASTCUT Pad 85 Assembly. Ordinarily, no adhesive is needed when sanding flats or slight contours...the surface of the FASTCUT Pad holds the disc in place. Full sheets, cut sheets and discs come in 180 and finer grit sizes.

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for higher lustre— smoother finish on metal parts

You can get a far superior finish on metal parts with the Super-Brite chips and compounds employed in the Grav-i-Flo Tumbling Process. Developed by originator of modern mechanical finishing, these materials also cut much faster, and eliminate the need of transferring parts from the cylinder between roughing and finishing operations. They likewise eliminate subsequent operations such as ball burnishing for color.

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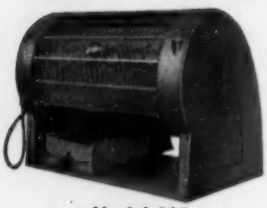
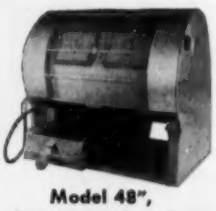
Grav-i-Flo offers complete equipment, accessories and supplies for all your tumbling needs!



Model 66", two compartments



Model 48", two compartments

Machines. Grav-i-Flo 66", 48", 36", 32", and 24" machines have cam locked doors with manually released safety stops; available with unlined or rubber lined cylinders, constant or variable speed drive, J.I.C. controls, and timers from 5 minute to 20 hour cycles. Equipped with electric wiring and water piping installed ready for plant hook up.

Model 36", two compartments

Model 32", two compartments

Model 24", two compartments

Designed For Small Lot Production and Laboratory Processing.

Compounds. Grav-i-Flo natural and synthetic deburring and finishing chips and highly developed compounds consistently outperform every type of tumbling process offered on the market.

Investigate. Grav-i-Flo superiority in equipment and supplies has been proved to hundreds of users in many different industries. Let us show you, too, at no obligation. Our representative will visit your plant, or you may send samples direct to us. Engineering Service available to all users.

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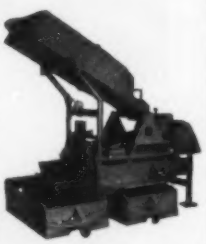
GRAV-I-FLO CORPORATION 400 Norwood Avenue Sturgis, Michigan

ACCESSORIES

Two deck parts-and-chips separator and chip grader.



Occupies less floor space. Separates parts quickly without impingements. Grades 3 sizes of chips simultaneously.

Other Grav-i-Flo accessories include tubular yoke hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

Circle No. 81 on Reader Service Card

PRODUCT FACTS
continued from page 68

Temperature Indicating and Controlling: 163
The latest catalog from Wheelco Instruments Div. of Barber-Coleman Co. describes the series 400 Capacitrols, electronic temperature control instruments for any temperature range desired.

Standard Die and Mold Parts: 164
Reduce die and mold costs by using standard components. Literature from Detroit Mold Engineering Co. describes many of the standard parts available.

Die Casting Machines: 165
The latest issue of the Lester Press describes some of the unusual die casting jobs that are possible on Lester-Phoenix machines. This quarterly bulletin is issued by Lester-Phoenix, Inc.

Hydraulic Pumps: 166
Bulletin W-414-B45, issued by Worthington Corp. describes several of the hydraulic pumps made by that company that are successfully being used in central station hydraulic systems in die casting plants.

Colloidal Dispersions: 167
Acheson Colloids Co. has just released a booklet listing 40 dispersions of colloidal graphite, molybdenum disulfide, vermiculite and zinc oxide in a variety of carriers. Given also are recommended uses of each dispersion.

Plastics for Casting: 168
Two reprints covering the use of plastics instead of wax for the disposable patterns in investment casting are available from Centrifugal Casting Supply Co.

Safe Hydraulic Fluids: 169
A leaflet from Swan-Finch Oil Corp. describes their new hydraulic fluid for minimizing fire hazards from hydraulic line breaks.

Welding Aluminum: 170
A comprehensive book, 175 pages, on the welding of aluminum has been published by the Aluminum Co. of America. Included are techniques, physicals of welded joints, inspection data, specifications, etc.

Iron Powder Reference Data: 171
Data sheets on iron powder for molding, cutting, scarfing and welding rod coatings are available from Easton Metal Powder Co. The company also has available a 4 page brochure showing, in pictures, the production process and the laboratory facilities available at the plant.

FINISHING

Buff Catalog: 175
A 12 page booklet covering the entire line of products manufactured by the Joe-D Buff Co. has been issued. Adequately illustrated, the catalog covers three main divisions: sisal buffs, cloth buffs and polishing wheels.

continued on page 77

Which of these jobs gives you trouble?

Oakite has 5 new ways to help you

Oakite chemists have developed efficient new materials for the 5 important jobs listed below. One of these new materials may provide the perfect solution for your most difficult problem.

1 **HEAVY-DUTY CLEANING IN TANKS:** New material combines the best qualities of alkaline and solvent cleaners.

2 **PHOSPHATE COATINGS:** One material cleans steel while applying dense iron-phosphate coating. Another surpasses government specifications for heavy zinc-phosphate coatings. Lasting paint adhesion, protection against corrosion, ease of control.

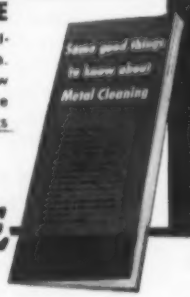
3 **ETCH-CLEANING ALUMINUM:** Uniform etching in preparation for anodizing or painting. Scaling and sludging minimized or eliminated.

4 **ELECTROCLEANING BRASS:** Efficient, economical cleaning without danger of tarnish.

5 **INHIBITING PICKLE BATHS:** Liquid inhibitor for sulphuric, hydrochloric and phosphoric acids. Saves steel, saves acid, builds own foam blanket to suppress pickling fumes. Easy to add to continuous strip or batch pickling operations.

FREE

Circle the coupon number corresponding to the job that gives you trouble. We'll send information about the new material for the work, also our 44-page illustrated booklet "Some good things to know about Metal Cleaning."



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

OAKITE PRODUCTS, INC.,
34G Rector St., New York 6, N. Y.

Send me a FREE copy of "Some good things to know about Metal Cleaning" and tell me more about the new Oakite material for the job (jobs) corresponding to the number (numbers) I've circled below.

1 2 3 4 5

Name_____

Company_____

Address_____

Circle No. 83 on Reader Service Card

now

you can get this brilliant finish directly on zinc die castings!

PART AS CAST

TREATED WITH NEW IRIDITE

No electroplating--no mechanical finishing!

NEW

IRIDITE® (Cast-Zinc-Brite)

brightens zinc die castings by chemical polishing, protects against corrosion

NOW, FOR THE FIRST TIME you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for FREE PROCESSING for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. *IMPORTANT: when you give us samples for test processing, please be sure to identify the alloy used.*

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals

Circle No. 74 on Reader Service Card

IMMERSION HEATERS . . . in single, double flange

Single and double flange-type heaters have been added to the Calrod immersion heater line.

The new heaters, designed to operate on either a-c or d-c circuits at 115 or 230 volts, can be used in water baths, cleaning tanks, humidifiers, quench tanks, stills, sterilizers, and similar equipment.

Offering a high watt density, the heaters are formed by bending a Calrod tubular unit into hairpin shape, the ends of which are brazed into a flange. A silicone seal and porcelain insulator are incorporated at the heater's terminal ends as a protective measure against vapors and liquids, and to provide electrical insulation.

General Electric Co.
For more information, circle No. 212 on the Reader Service Card

FOUNDRY GRINDING WHEEL . . . for use up to 6500 sfm

A new vitrified grinding wheel for foundry use at speeds up to 6500 surface feet per minute has been announced.

Known as the "K" Bond snagging wheel, the wheel is reported to give up to 30 percent longer life with faster, freer cut. "K" bond was designed for silicon carbide wheels in rough grinding cast iron.

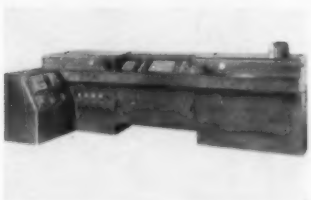
Other advantages of the new grinding wheel are that less dressing is required to keep it sharp, the corners hold up longer without rounding, and the wheels can be consistently duplicated from wheel to wheel and lot to lot. Operator fatigue is lessened.

"K" bond wheels can be made in all sizes, shapes, grit sizes and grades used on floor stand, bench stand, swing frame and portable grinders of the slow speed (6500 s.f.p.m.) type for snagging gray and hard malleable iron castings.

Norton Co.
For more information, circle No. 202 on the Reader Service Card

To get copies of any item listed here, simply circle the appropriate number on the Reader Service Card bound into this issue.

New Products ... the Reader Service Cards will bring full details



SPRAY DECORATING MACHINE ... is fully automatic

A new fully automatic spray decorating machine which incorporates an integrated mask washer has recently been put into production. The machine accommodates the spraying of small parts, or pieces up to 24 in. long by 7 in. wide.

Mask washing of one set of masks takes place in this traversing gun machine during the painting operation and without the necessity of removing the masks. This saves valuable time otherwise lost by regularly stopping the machine to remove soiled masks and fill with clean ones. The operator merely throws a switch and immediately clean masks are shuttled into position for painting. The machine can also be designed for two operators employing 8 masks.

Units, now in use, are producing 2400 pieces per hour per operator, this is doubled with two operators. Parts are painted on both the forward and return stroke of the gun. Where the guns are stationary the machine can be made to cycle up to 3600 pieces per hour if the operator can load it that fast since there is no time lost by gun travel.

Conforming Matrix Corp.
For more information, circle No. 196 on the Reader Service Card

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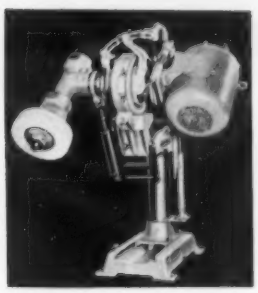

POLISHING HEAD ... is heavy-duty, multi-position

A new, heavy-duty, multi-positioning buffing head with many unusual features has been announced.

The new head, known as the No. 55 can be positioned for any job by means of simple, conveniently located adjustment controls on the front of the head. It can be rotated in a full 360 degree swing on both axes, simultaneously; and automatic positioning provides constant, full contact on even the most irregular shaped piece. An adjustable float restrictor controls the degree of rise and drop of the wheel.

Pneumatic controls for wheel lift-off are available for fully automatic installations. The fine centering of wheel over work is quickly accomplished by means of additional positioning ways on the head mounting bracket.

The Murray-Way Corp.
For more information, circle No. 197 on the Reader Service Card

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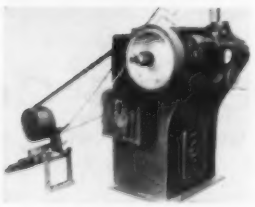


BACK STAND IDLER ... has simple tracking

A new heavy-duty backstand idler with a 6 in. wide plastic wheel has been developed for use with belt grinding machines. Its width affords flexibility in grinding belt selection. Two remote control arms are said to offer more accurate tracking and tensioning than most other idler designs.

Width of the idler wheel permits a belt width range of ¼ to 6 in. Use of plastic in the wheel prevents marring of the surface by abrasive particles that interfere with proper tracking and shorten wheel life.

Called the L-26 Backstand Idler, the unit has two control arms within easy reach of the

Continued on page 75

If time meant money he'd drill and tap with

Bellows-LOCKE DRILL UNITS

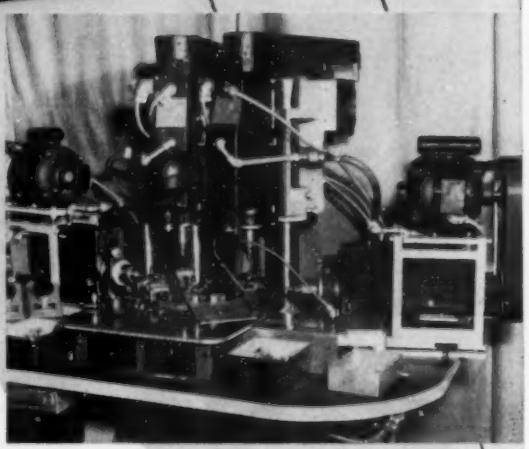
An extra second or so drilling a hole may not mean much to a woodpecker. But in today's cost picture it means dollars to you.

If you have any part in which you are drilling or tapping two or more holes in any size up to 1/4" or 5/16", The Bellows-Locke Drill Unit offers practical opportunities for substantial cost reduction.

It is particularly effective as a basic component for toolroom-built special purpose drilling and tapping machines. It is compact, streamlined, relatively light in weight, can be installed in any angle in any plane. Any number of units can be easily synchronized and interlocked for accurately timed sequence operation.

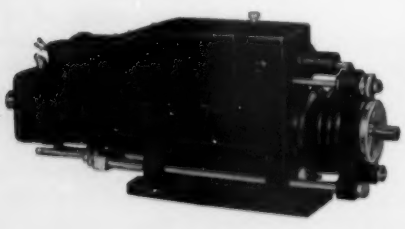
The spindle is electrically driven (either pulley drive or direct motor drive). Rapid advance and retract is by pneumatic power. Feed rate is hydraulically controlled. All three circuits: electric, pneumatic and hydraulic are interlocked for simple, positive push-button control.

Major cost reductions are often the accumulated total of many minor savings. Look at your drilling and tapping costs with a critical eye.



WRITE FOR THIS BOOKLET—

Describes the Bellows-Locke Drill Unit in detail—shows how and where it can be used to best advantage. Free on request. Address: The Bellows Co., Dept. PMM 854, Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., 4972 Dundas St., W. Toronto, Ontario, Canada.



The Bellows Co.

AKRON, OHIO

911-A

Circle No. 75 on Reader Service Card

operator at the grinding lathe. One arm controls the tilt of the wheel to allow control of tracking without changing the center to center wheel distance. The other arm controls belt tension by allowing the idler wheel to be slid forward or backward.

Fenlind Engineering Co.
For more information, circle No. 198 on the Reader Service Card

---

COMPACT PRESS
. . . designed for trimming

A new hydraulically operated press that has been specifically designed for trimming operations has been introduced.

The press is compact in size, is only 8 ft. high and requires about 22 sq. ft. of floor space. Since it is designed for trimming operations only, it does not have, 22—Precision Metal 8706 62-3 nor require, the power necessary for a forming press. It uses only the time and power required for the particular job being done.

Pieces up to 16 in. square and 6 in. high can be accommodated. The ram stroke is 15 in. and requires 4 seconds for a complete cycle.

The Steel Products Engineering Co.
For more information, circle No. 204 on the Reader Service Card

---

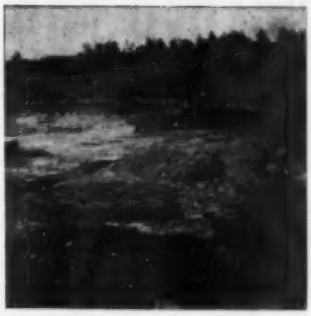
SILICONE FLUIDS
. . . for mold release

New silicone materials known as Vascasil fluids are now being marketed for use, among other things, as mold release agents.

Their inertness and heat resistance, coupled with the fact that they do not carbonize or de-

Continued on page 98

Circle No. 85 on Reader Service Card



WE OWN THIS QUARRY

The products of this Wisconsin quarry have been used for many years by a nationally prominent tumbling supplier, whose name will be furnished upon request.

Processed Limestone and Granite Chips
FOR PRECISION TUMBLING

Other tumbling supply companies charge 15¢ a pound for these same chips. We charge only . . .

8¢ LB. Packed in 100 lb. bags. Prices f.o.b. quarry.

. . . because we sell direct from quarry to manufacturer.

X100 BURNISHING COMPOUND 20¢ LB.

For years the products of this quarry have been used in processing parts for the majority of American manufacturers including:

FORD	GENERAL ELECTRIC	BORG-WARNER
GENERAL MOTORS	DE VILBISS	WHIRLPOOL
CHRYSLER	WESTING-HOUSE	DOEHLER-JARVIS
BENDIX	AUTO-LITE	MINNEAPOLIS-HONEYWELL

CHIP SIZES
#1 1¼ to 1¾ #3½ ½ to ⅝
#2 ⅞ to 1¼ #4 5/16 to ½
#3 ⅝ to ⅞ #5 ⅛ to 5/16
Other sizes on request.

Write today for FREE chip samples so you can compare them.

UNIVERSAL TUMBLING SUPPLY CO.
Phones: VE 8-2071 • WO 3-9445
14337 MANSFIELD • DETROIT 27, MICHIGAN

RARE
but available
AT ADVANCE

It takes EXPERIENCE as well as technical background to make Quality die castings, ADVANCE has thirty-three (33) years of die designing, die building and die casting experience under its belt to assure precision component parts that fit your product assemblies with minimum fuss, lower costs and on time.

That's why ADVANCE customers are both near and far. IT IS QUALITY THAT ATTRACTS ITS OWN.

Yes . . . some ADVANCE customers are over a thousand miles distant. After all, there can be no distance boundaries when experience and high quality die castings are needed.

33 years of service to industry

ADVANCE operates under the CERTIFIED ZINC PLAN of the American Die Casting Institute.

ADVANCE TOOL & DIE CASTING CO.
3760 N. Holton Street
Milwaukee 12, Wisconsin

Circle No. 3 on Reader Service Card

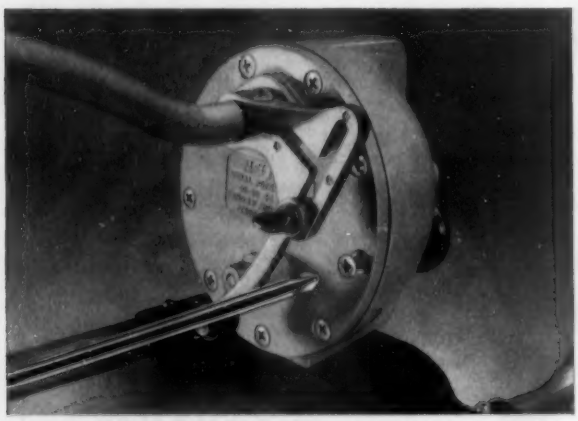
Are Your Fasteners HEADED FOR TROUBLE?

P-K STANDARDS protect you against these and many other symptoms of Screws "headed for trouble". They don't "get by" P-K inspectors—that's why *all* P-K Self-tapping Screws can be "Guaranteed First Quality".

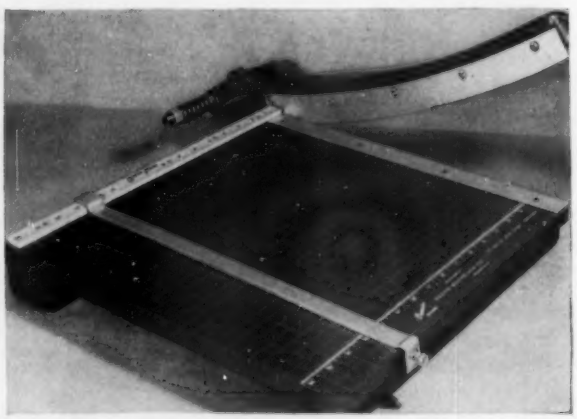
Screws are sometimes like people. If they "lose their heads" under pressure — if they turn out to be "softies" — if they don't "square up," they are headed for trouble.

The difference between screws made to P-K Standards and those that are "headed for trouble" is hard to see at a glance, but the effects of screw failure (parts spoilage, high reclamation expense, hidden weakness) are quickly evident in mounting assembly costs and customer complaints.

P-K Self-tapping Screws are "headed for savings" — not only headed, but threaded, pointed, and heat-treated with the same purpose — to keep your assembly lines trouble-free. That's why so many *more* manufacturers of America's best-known products specify P-K. For information on any fastening problem, talk to a P-K Assembly Engineer. Or write: Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14.



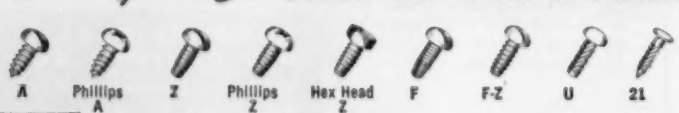
"SWINGIN' SPRAY," MELNOR Products Co.'s popular lawn sprinkler keeps on "swinging" because the oscillating mechanism is separate and sealed from the water intake system. To assure equally dependable assembly strength, resistant to the roughest handling, Melnor fastens zinc and aluminum parts with P-K Screws, 7 Phillips Head Type Z and 18 Type F, driven with air tools.



IN THE PREMIER CUTTING BOARD, made by Photo Materials Co., when 21 P-K Type A replaced wood screws to fasten the ruler, straight blade, bearing casting, and bottom cleats to the hard maple board, pilot holes were eliminated. The 5 P-K Type F Screws that now fasten curved blade to cast iron handle ended tapping. Power driving further speeds assembly.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**



IN STOCK . . . see your nearby P-K Distributor

Circle No. 84 on Reader Service Card

USEFUL LITERATURE

continued from page 71

Blast Cleaning and Dust Control: 176
A new catalog has been issued by the Pangborn Corp. covering the entire line of blast cleaning and dust control equipment made by the company. The 24 page booklet is well indexed and all equipment and accessories are listed by equipment, type and purpose.

Metal Protection and Paint-Bonding: 177
A new ACP check list of metal-protective and paint-bonding chemicals for steel, zinc, aluminum and other metals with industrial applications has been issued by the American Chemical Paint Co.

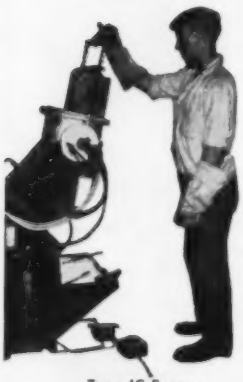
Racks and Tips for Finishing: 178
A new 24 page catalog has just been released by Narco, giving fundamental information on racking methods and tip constructions for plating and finishing.

Pull-Up Broaching Machines: 179
A four page bulletin (RU-54) has been issued by Colonial Broach Co. giving full details of the

Continued next page

Fast **DIRECT-CAST**

Investments...with new Detroit Furnace



Type IC Furnace with mold attached.

This new direct-casting Detroit Electric Furnace produces better precision castings in less time. Fast, indirect arc melting plus direct furnace-to-mold casting cuts production cycle to as little as 7 minutes.

Uniform melts bring lowest reject rate, increases over-all efficiency. Low power consumption, high utilization of heat for operating economy. Get full information on Type IC Detroit Electric Furnace for higher precision casting production. Write today!

FEMA

DETROIT ELECTRIC FURNACE DIVISION
KUHLMAN ELECTRIC COMPANY
1070 26th St. • BAY CITY, MICHIGAN

Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D. F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.

Circle No. 43 on Reader Service Card

Former Material Cost 30% More For This

Magnesium Yard Light Reflector

Many users of items die cast from non-ferrous metals are under the impression that magnesium, while extremely desirable for certain uses because of its light weight, is too costly. However, with the manufacturing and engineering know-how facilities offered by LITEMETAL DICAST, INC., it has been proved that magnesium products *need not* be too costly. Great savings can be effected with magnesium . . . in fact, this die cast yard light reflector formerly cost 30% more to produce when die cast from another material. In addition, the lighter weight of magnesium throws less load and strain on the supporting brackets.

Further cost reductions for this reflector were effected because:

1. The few machining operations required are more readily done with magnesium than with any other material.
2. The shipping cost of the final product is greatly reduced because of magnesium's lighter weight.

Let's Talk It Over . . .

LITEMETAL DICAST, INC., is an organization of specialists—men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs—little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large structural parts. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST, Inc.
A DIVISION OF HAYES INDUSTRIES
1925 WILDWOOD AVE • JACKSON, MICHIGAN
PLANT AND EXECUTIVE OFFICES

Circle No. 45 on Reader Service Card

design and operation of the entire line of pull-up broaching machines made by that company.

Oil and Moisture Separator: 180
Full information and literature is available from the DeVilbiss Co. on their new oil and moisture separator for cleaning of compressed air. The manufacturer states that the unit operates at 50 c.f.m. and gives steady air flow up to 135 psi from a 250 psi line.

Grinding and Cutting Wheels: 181
The Norton Co. has published a 28 page booklet describing and illustrating its complete line of reinforced resinoid grinding wheels. Wheels discussed are straight cutting off wheels, hub wheels, etc.

Drilling and Tapping Machines: 182
Bulletin G54 by the Edlund Machinery Co. answers machine tool buyers and engineers problems regarding functions and capacities of drilling and tapping machines. Included is a chart of the specifications for drilling and tapping machines.

Paint Spray Masking Equipment: 183
Two new bulletins, one on spray mask washing machines and the other on automatic spray mask painting machines have been issued by Sepanski & Associates.

Vacuum Metallizing: 184
A bulletin describing the advantages and applications of vacuum metallizing has been published by the Red Spot Paint & Varnish Co.

Spray Painting Equipment: 185
The newest catalog from Finish Engineering Co., Inc. describes, in detail, and illustrates many of the machines, masks, wipers, etc. made by the company for high speed automatic paint spraying.

Cut-Off Wheels: 186
A bulletin covering recommended specifications and wheel sizes for reinforced foundry cut-off wheels has been issued by the Manhattan Rubber Div., Raybestos-Manhattan, Inc.

Abrasive and Cutting Tools: 187
A new abrasive and cutting tool catalog containing seldom-found information has been prepared. A 40-page book, it contains charts of grain and grade recommendations for specific jobs, safe operating speeds, tool selection charts, etc. The catalog is published by Metal Removal Co.

Carbide Coatings for Wear Surfaces: 188
Flame-plating, a process for depositing thin coatings of tungsten carbide on the surfaces of parts and many tools where extra resistance to wear is required, is the subject of a new, 16-page booklet just announced by Linde Air Products Co., Div. of Union Carbide & Carbon. Advantages, properties, specifications and applications are included.

ANCOR 80
SPONGE IRON POWDER

FOR
PURITY, STRENGTH, UNIFORMITY & ALL-ROUND SUPERIOR RESULTS
HOEGANAES SPONGE IRON CORP.
RIVERTON, N.J.
DISTRIBUTED BY
EKSTRAND & THOLAND, INC.

Circle No. 34 on Reader Service Card

Diamond Compound for Die Polishing: 189
Complete details and prices of a new diamond compound known as Super-Lap for polishing dies and molds that require high quality finish, are available from Acme Scientific Co.

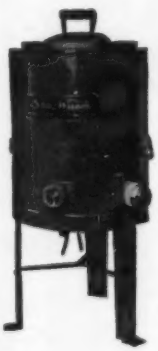
OPPORTUNITIES

SALESMAN WANTED: To sell exceptionally good line of Die Casting equipment and Compression presses. Write Box No. 8154 PRECISION METAL MOLDING magazine.

INVESTMENT CASTING METALLURGIST wanted by prominent precision casting company located in midwest. Experience desired in high temperature alloy work or titanium casting. Give details of education and experience. Write Box No. 8254 PRECISION METAL MOLDING magazine.

MANUFACTURER'S REPRESENTATIVE wanted by the nation's largest producer of Short-run Stampings. Companion lines permitted. Desirable commissions on an exclusive assigned territory. Write Box No. 8354 PRECISION METAL MOLDING magazine.

IF Wax Molding for Expendable Patterns is the procedure you require,



LOOK to Sta-Warm
for dependable heating pots and tanks for the economical production of uniformly melted wax.

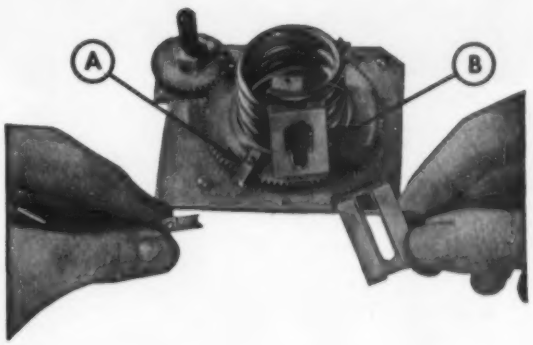
WRITE for catalog literature describing Sta-Warm electrically heated wax melting and dispensing equipment.

Top—"WV" wax tank with close tolerance temperature control.
Bottom—"WV" wax pot, built in wide variety of sizes.

Sta-Warm ELECTRIC CO.
525 N. CHESTNUT ST. • RAVENNA, OHIO

Circle No. 68 on Reader Service Card

RADIO TRANSMITTER PARTS
Made From Brass Powder



For Quality At Low Cost

The above two parts are A and B in this radio transmitter driver grid. They are pressed from a 90-10 brass powder by American Sinterings of Watertown, Conn., for the Radio Receptor Company to provide the required dimensional accuracy, strength and corrosion resistance at low cost. Perhaps these brass powder applications will suggest some production shortcuts for you.

The larger of the two brass powder parts requires only the drilling and tapping of two end holes prior to plating for assembly. The alternative method of production would undoubtedly be extrusion from bar stock entailing not only the drilling and tapping, but elaborate milling to form the slot and channel (with considerable scrap loss) and a cut-off operation as well. The tolerances held in this powder part are of the order of ± .005.

Production of the smaller part by powder metallurgy involves only the drilling of one hole. If extruded, both ends of the part would have to be milled to achieve the required contours and a cut-off as well as the drilling operation would be necessary.

To provide designers, engineers and metallurgists with a concise reference to the factors which should be considered in designing for powder metallurgy, we—the makers of Horse Head metal powders—have published a 32-page handbook FACTS ABOUT PRESSED BRASS and other nonferrous POWDER PARTS. Ask us for a copy.

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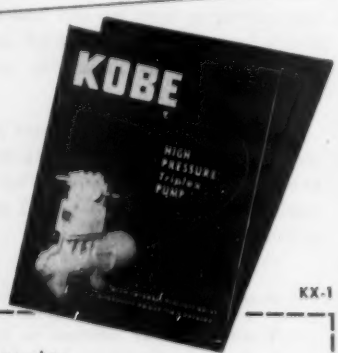

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GAMES OF SKILL
continued from page 36

finished piece costs are compared compensates for the higher initial cost for tooling.

Consider, for example, the complex link (B) die cast with two hollow bosses of irregular shape, and a triangular solid boss. This piece also has a deep slot in one edge, and a through hole . . . and all of these features are present in the casting as it comes from the die. Consider the number of precise machining or assembling operations needed to produce this otherwise, and you will have an idea of the saving possible when finished piece costs are compared.

The use of die castings has permitted Philadelphia Toboggan Company to produce a precise, long-wearing mechanism without heavy investment in capital metalworking equipment. Since the company also has a large woodworking department to produce cabinets and other amusement equipment, it has been found desirable to keep expenditure for metalworking tools at a minimum.

Over-all, these die cast components have proved to be economical, durable and accurate. They are typical of the many hundreds of such small die cast components now in use in the amusement industry.

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BRASS POWDER
continued from page 47

sities of 7.80 to 8.00 or higher.

However, there is another factor to be considered.

At least part of the cost of a part results from die amortization and tool changes. Wear of the dies or tools is caused by the abrasion of the powders and the greater the pressures used, the greater the wear. Also, the density is not a straight line relationship with the pressing pressure. Figure 6 is a graph showing the pressure required to achieve a given density when parts are sintered at 1620 F. and 1580 F. using ½% lubricant and 1% lubricant.

Notice that in the lower densities, an increase in pressure yields an equal increase in density but as we get into the higher densities, a greater increment in pressure is required. If we extrapolate the two curves, it is apparent that we cannot achieve 100% density which is 8.6. In practice, this has been borne out. Even at 75 or 100 tons pressure, some porosity will still remain.

Sintering time and temperature are also factors. However, it is impossible to reach 100% density by these means. We can, of course, melt the parts but we then lose all control of the shape of the part. Even to increase a sintered density by increased sintering time imposes an impractical factor on the fabricator.

It, therefore, boils down to a balancing between the properties that are practical to achieve and those that are desired for the part. Actually, this is not so difficult nor so unreasonable as might be supposed.

If by pressing and sintering, properties still fall short of those desired, the parts can be repressed or coined. Although this imposes an additional operation and, therefore, an additional expense, the increased values for tensile and hardness may offset the disadvantage.

It is rather difficult to present the properties developed by coining since they are naturally a

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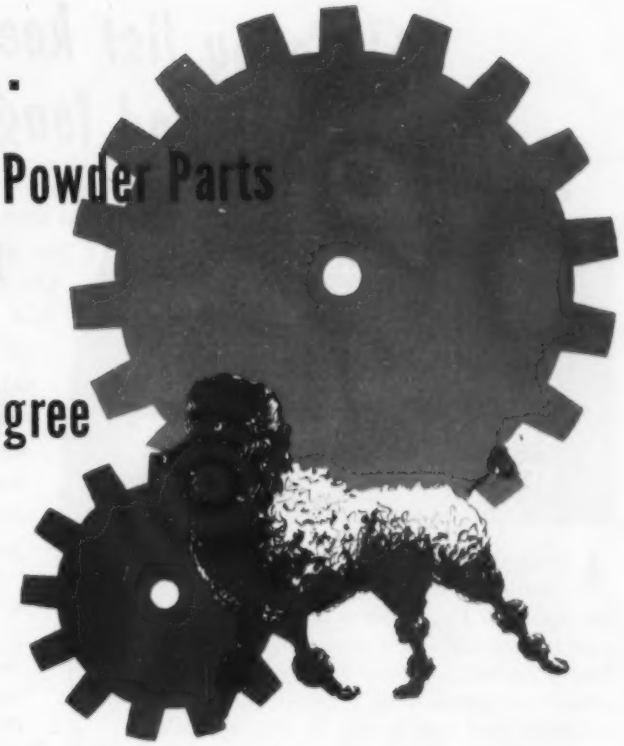
Iron Powder Parts with a Pedigree



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Powder metal parts can now be compacted from electrolytic iron powder with tensiles in excess of 100,000 psi in one sintering by the addition of small percentages of Metal Hydrides' pre-alloyed chrome-nickel powders. This combination eliminates costly copper infiltration, yet assures maximum strength regardless of the size of your compact.

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Cannon-Muskegon can supply scores of special and standard alloys for remelt or reprocessing, certified to your exact specifications

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AMS 5385B
AMS 5388
PWA 651
ARMCO 17-4-PH
4750
AISI 300 SERIES
AISI 400 SERIES
*MONEL
*INCONEL
ACI-H7
18-4-1
IIB2
IID2
INVAR
CO-CR-W ALLOYS
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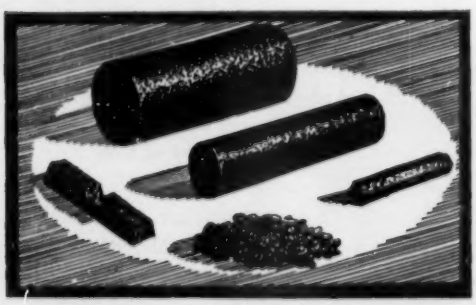
A *long* alloy list is an excellent indication of long alloy experience! As source for many of the nation's major investment casting suppliers and others, Cannon-Muskegon furnishes a great variety of alloys for remelt or reprocessing. Alloys include super stainless and tool steels, as well as nickel and cobalt-base alloys. Other alloys are prepared specially for medical, aeronautical, electronic, industrial and experimental uses.

These alloys are in addition to a wide range of carbon and 300 and 400 series stainless steels regularly carried in stock for *immediate* delivery. Remember . . . no matter what type alloy you specify each is backed with a notarized metal analysis insuring *exactly predictable* physical, chemical and electrical properties.



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function of the amount of "work" or deformation done to the part. However, an increase of 50% in tensile and hardness is not unusual.

FLASH REMOVAL
continued from page 67

not made apparent by the former method of deflashing, each casting to hold a liquid had to be submitted to water testing. This was a slow process, with only about 500 pieces tested in a day's time. Now, as with those castings to be painted, blast deflashing makes the laminations apparent and permits visual inspection. Eliminating all the blistered parts does not eliminate all leakers, but by water testing only the castings without blisters, the company is able to save many man hours formerly spent on this work.

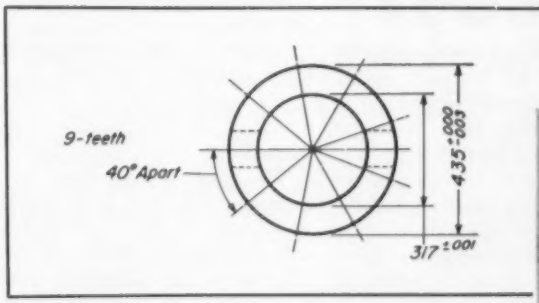
IMPOSSIBLE to fit a trim die inside, but blast cleaning removes all loose material from interior and saves 20% on these motor housings shown before and after deflashing.

Officers of the company report that they save as much as $2000 per month in various costs by automatic blast deflashing. And with the standard of inspection they now have, plus the uniform surfaces obtained, the sales appeal of their product has been greatly increased.

PROTECTING MAGNESIUM
continued from page 63

De-ionized water immersion for 850 hours produced no visible corrosion products on Iridite treated panels, while a few points of breakdown occurred on dichromate panels under the

Simplified Solutions for product design problems



FIVE PARTS FOR THE PRICE OF ONE . . . that's the story of successful redesign of this electrical connector component which is now being made as a powdered metal component by Kwikset Powdered Metal Products for Cannon Electric Co. The part, a fixed ratchet for a disconnect mechanism in an electrical connector, is produced in a material whose physical properties are equivalent to 1010 steel heat treated to Rockwell C 35-40. Critical tolerance on the tooth detail is held to ± .001. Comparison of costs with previous manufacturing methods shows a reduction of 80 percent.

IS SECTION VARIATION in a powdered metal part possible in the direction of pressing? Here is a good example of the way powder metallurgy has produced a complicated little part that would be difficult by any other method . . . and it includes considerable variation in section. It is a fluted ravioli noodle cutter wheel, pressed from bronze powders and sintered by The Bassick Company, a Division of the Stewart Warner Company.

same condition. Gas bubble formation on the dichromate panels was limited to the areas in which breakdown occurred. On the Iridite panels, gas bubbles were small and were distributed evenly over the entire surface.

In four months of outdoor exposure of painted panels showed good paint, adhesion on both dichromate and Iridite panels.

Galvanic Corrosion

Since Iridite #15 is a relatively good conductor of electricity, among non-metals, it cannot prevent galvanic corrosion. This can be accomplished only by insulating the surfaces of the dissimilar metals. However, Iridite can reduce galvanic corrosion to low levels, particularly when the dissimilar metal can also be Iridite treated. Figures 2 and 3 (Galvanic corrosion photographs)

Applications

A considerable amount of the magnesium finishing done at present is on equipment for the Armed Services. Air Material Command at Wright-Patterson Air Force Base is the custodian for the applicable specification, MIL-M-3171. This is not a performance specification since no accelerated-corrosion test has been accepted officially as giving a fair evaluation of the performance of treated magnesium surfaces. It is a process specification only, and describes the accepted methods for four treatments.

Type I is the Chrome Pickle treatment, used mainly as a manufacturers temporary protective treatment for castings. Type II is the Sealed Chrome Pickle. This gives a high degree of protection but the dimensional change is governed by the Chrome Pickling step and is fairly large. Type III is the Dichromate Process, which is used widely. It gives good protection with little dimensional change. Type IV is the Galvanic Anodizing method.

In comparative corrosion tests the Iridite #15 process showed itself to be at least equal to the Type II, III, and IV treatments in the specification.

The treatment time is as short as that of the Type I treatment with more protection and lower metal loss. Consequently, the Air Material Command has agreed to permit substitution of Iridite for the specification treatments in a sufficient number of installations to obtain pilot plant experience.

Some of the applications, to date, are shown on page 61.

Discussion

The use of chlorides in the surface treatment of magnesium is controversial. In many previous processes using chlorides they were not balanced correctly with the other solution components and were retained in the film in soluble form. In the presence of moisture, this condi-

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tion promotes corrosive attack on the metal.

Chlorides have been used with considerable success in chromate conversion treatments for other metals for a number of years. In the Iridite #15 process, the chloride is an active film forming constituent but its effect is apparently catalytic. Tests have shown that soluble chlorides retained in the film, after only a perfunctory rinse, are as low as three or four milligrams per square foot of surface. Similar quantities are found in coatings from the dichromate process. In this case the chlorides are thought to come from tapwater used in rinsing and makeup or from the normal impurities in the dichromate.

The possible ill effects of retention of chlorides in recesses is typical of a problem which exists in one form or another with many finishing processes for all metals. Inadequate rinsing is encountered frequently in the metal finishing industry. Even simple shapes, after a cleaning or acid dipping operation, need at least a 15 second rinse in clean water before rinsing can be called adequate to prevent contamination of succeeding solutions. A number of examples have appeared in chloride free treatments where inadequate rinsing caused trouble varying from streaking of the finish to apparent corrosion. The so-called corrosion products turned out to be crystals of alkaline cleaners which were not rinsed thoroughly. The simple expedient of alternate hot and cold rinsing at the proper point has corrected the conditions even in the case of intricate spotwelded sheet metal assemblies.

To determine the actual effect of Iridite #15 solution trapped in recesses, the following trial was run. Treated panels were laid out horizontally and drops of the Iridite #15 solution from full strength down to a 1-19 dilution were placed on the panels. The wet spots were covered with other panels in intimate contact to stimulate various degrees of rinsing. All were aged in the laboratory atmosphere for 3 months. At the end of this time there were no signs of attack on the panels by the entrapped solution.

These results would indicate that any entrapped solution is depleted quickly on the metal surface with no corrosive residues.

References

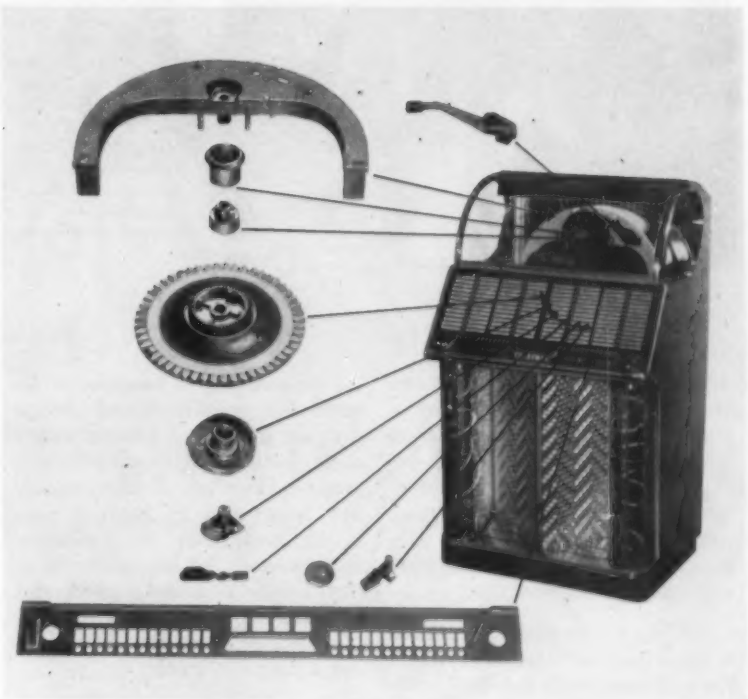
(1) Bleiweis and Fusco — "Protective Treatments for Magnesium Alloys" *Metals and Alloys* (February 1945)

(2) Digging — "Surface Treatments for Magnesium" *Metal Finishing Guidebook* (1953)

(3) Barbian — "How To Finish Magnesium" *Modern Metals* (December 1953)

(4) "Magnesium Finishing" The Dow Chemical Co., Midland, Michigan

ACCURATE Aluminum, Zinc and Magnesium Die Castings help WURLITZER



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■ To help maintain its reputation for high quality products that are competitively priced, the Wurlitzer Co. specified ACCURATE die castings. They were sure that every die casting would meet every specification. Cast to close tolerances, these castings required little or no machining, are light in weight, and are ready to use as cast.

Whether it's aluminum, zinc or magnesium die castings, ACCURATE is completely set up to help you with your requirements.

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Industry News

Companies · Plants · Associations

Styling Service Offered Buyers Of Die Castings . . .

Col. Alexis de Sakhnoffsky (seated) shows samples of his latest design creations to Herman E. Pleasant (left) president of Grand Rapids Brass Co., and B. A. Briton, vice president. de Sakhnoffsky has been retained as a design consultant for the company's customers.

In what is believed to be the first such service offered by a contract die casting firm, Grand Rapids Brass Company has announced the retention of internationally known designer, Col. Alexis de Sakhnoffsky, to consult with its customers' designers on styling problems.

Col. de Sakhnoffsky's function is described as "liaison styling". He will work with the design departments of customers to assist them in meeting the practical requirements of production economy while maintaining the original styling quality desired.

He will also work with customers' designers on detail work such as handles, nameplates, escutcheons where the over-all planning has been done, but not the hardware detail.

Sakhnoffsky came to this country from Europe in 1928 and has established a successful career as a designer here as well as abroad. He is considered an authority on automotive design and has pioneered several major style trends. His drawings and commentary on design trends are featured in leading consumer magazines. As a practicing designer, he has accounts in the fields of metal, wood and plastics, recently receiving special recognition for his design for a fork lift truck.

Herman E. Pleasant, president of Grand Rapids Brass, said Sakhnoffsky's appointment is in line with the company's policy of offering additional customer services.

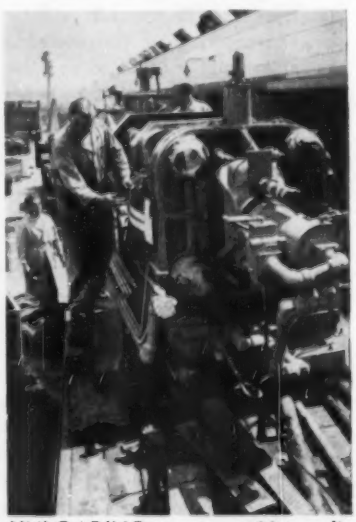
This new customer service is seen as part of a long range expansion program which includes construction of a half million dollar plant. In addition to its contract die casting, the company also manufactures a line of plumbing hardware. It is a division of Crampton Manufacturing Company.

CONTRACT DIE CASTING DIVISION ESTABLISHED BY McCULLOCH MOTORS

A new addition to the products and services offered by McCulloch Motors Corp. has been revealed by Robert P. McCulloch, president of the Los Angeles company, who has announced the formation of a Light Metals Division, set up to mass-produce high-pressure magnesium and aluminum die castings on order, as well as related machining and die making.

The announcement was concurrent with the latest expansion of the company's die casting facilities, which have been increased to 200,000 pounds per month of magnesium castings by the addition of two new 600-ton Lake Erie machines.

Joe McKellar, who was named general sales manager of the new



UNLOADING two new 600-ton die casting machines at McCulloch Motors is evidence of company expansion into the contract die casting of aluminum and magnesium.

division, has explained that this is another step in the company's diversification program. Long known as a leading manufacturer of gasoline-powered chain saws, the company recently entered the automotive field with a new type of supercharger. McCulloch is also supplying mechanical and optical items to the aircraft industry.

The new equipment installed in the McCulloch plant this week is reported to give the company the largest high-pressure magnesium die casting facilities in Southern California, with 15 machines, including Lake Erie, Reed Prentice, Cleveland Automatic and Lester-Phoenix equipment.

Die castings in magnesium can be cast in any weight up to 8 pounds, in any size up to a projected area of 400 square inches.

B-L-H BUYS COMPANY

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa., has announced acquisition of all outstanding stock of the O. S. Peters Company in Washington, D. C., manufacturers of devices for materials testing equipment and electronic specialties. No changes are contemplated in personnel or headquarters of O. S. Peters.

The addition of these product lines in the electronics field is another step in Baldwin's continuous program of diversification which now includes 40 product lines with more than 100 markets.

BUILD RESEARCH CENTER

Construction has started on Jones & McLaughlin Steel Corporation's new research center, it has been announced by Herbert W. Graham, vice president in charge of research.

The laboratory, to be completed in mid-1955, will be located on Baldwin Hill, Pittsburgh, 400 feet above the Monongahela, overlooking J&L's Pittsburgh Works.

The new research center, to cost initially more than $1,500,000, will consist of several buildings, housing a research staff of about 100.

ADM. KIRK REPORTS MORE MERCASTING USES

Greatly increased applications for the Mercast process in the production of investment castings was cited by Admiral Alan G. Kirk, chairman of the board of the Mercast Corp. before its annual stockholders meeting. Admiral Kirk further stated that "both the production capacities and the technological proficiency of our operating licensees have likewise grown to keep pace with increased industry demand. And Mercast royalty receipts have reflected this growth."

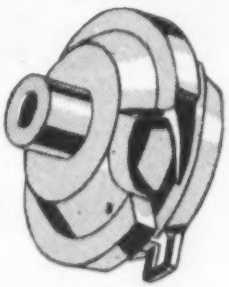
The corporation, which controls rights for the process bearing its name, lists four licensees, all located in Cleveland. They are Alloy Precision Castings Co.,

Continued next page

A stitch in time — on these sewing machine parts . . .

SAVED 50%

with plaster mold castings by Universal



Two castings replace a three-piece assembly that had to be turned, milled, drilled, shaped, filed, ground, heat-treated and polished.

This sewing machine unit holds the bobbin and controls the thread and stitch. Vital to smooth machine operation, it has to meet high strength, dimensional tolerance and surface finish requirements. As machined parts, trouble was encountered on all three scores: failures cropped up on the hook section despite heat-treating; rough spots sometimes snagged the thread. As plaster mold cast by Universal, the parts are held to tolerances of .005" per inch. They need no heat-treatment: their minimum tensile strength is 100,000 psi. The chrome plated castings give fine wearing quality without snagging. If high cost, tolerances or poor surface finish is your problem, then check with Universal.

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More Mercasting — cont.

Industrial Metal Castings Corp., Kolcast Industries, Inc., and Thompson Products, Inc. The process utilizes frozen mercury for the making of expendable patterns used in the manufacture of investment castings.

At the annual meeting, the stockholders re-elected its Board of Directors which includes, in addition to Admiral Kirk, Frederick C. Crawford, chairman of the board, Thompson Products, Inc.; Harold W. Harwell, consultant; L. Boyd Hatch, executive vice president, Atlas Corp.; Waldo M. Hatch, president, John C. Paige & Co., Inc.; Richard C. Patterson, Jr., corporation executive; M. L. Sindeband, chairman of the board, Housatonic Public Service Co.; S. J. Sindeband, Mercast president and president of Alloy Precision Castings Co., and Peter D. Kleist, The Merrick-Kleist Construction Co.

Admiral Kirk also announced that basic negotiations are now being completed with respect to the introduction of the Mercast Process into the United Kingdom.

LETTERS

continued from page 10

prepare the graphs by using the data given on the various tables. —A. L. A. (President).

We are caught with our typos down. Reader A. L. A. is correct that something was left out on page 44. The sintering temperature should have been 1120 C instead of 120 C. While on the subject, we might also point out another type in the same paragraph . . . the word "associated" should have been "dissociated", in referring to dissociated ammonia.

On the other two points, we have checked with Mr. Mazza who advises us that diameter changes are in inches per inch, and the growth or shrinkage is based on the actual die size of 1.001 inch in diameter.—Ed.

Safety Award Given . . .

On behalf of the employees of Union Carbide and Carbon Corporation, Morse G. Dial, UCC's president (left) is shown accepting the Award of Honor for UCC's accomplishments in safety during 1953, from Ned Dearborn, president of National Safety Council. The Award is made for improvement in frequency and severity rates below par rates established by the Council. During 1953, the accident frequency rate for UCC employees was 3.6 disabling injuries per million manhours worked. This is 73 per cent below the similar rate for all United States industries. Although in previous years individual companies of UCC have received the Award, this is the first time the Award of Honor has been presented to the Corporation as a whole.

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SPECIAL VACUUM MELTING PROCEDURE IMPROVES TITANIUM QUALITY

Increasingly large titanium remelting furnaces, and substitution of a special vacuum melting procedure for conventional inert gas atmospheres in such furnaces, have had a dramatic effect on metal quality and point the way to significant cost reduction according to the Titanium Metals Corporation of America of Henderson, Nevada, and New York, N. Y.

The giant 20-ton automatic double-melting furnace of proprietary design here shown for the first time completely remelts 4,000-pound titanium ingots with improved metal homogeniety.

The perfection of the new melting process, instead of relying on the usual procedure of flooding the furnace with slightly positive pressures of argon or argon-helium mixtures, permits removal of hydrogen from the titanium metal down to as low as 0.005 percent or 50 parts in a million. Hydrogen has recently been shown to be more detrimental to titanium's physical properties than had heretofore been suspected.

The new vacuum melting procedure also has demonstrated other important advantages: more stable electrical arcs; the ability to accommodate greater power inputs; and the production of smooth ingots requiring little or no conditioning prior to continuous mill conversion into sheet and strip for military airframes or direct fabrication into bars and billets for jet engines.

It was about three years ago that Titanium Metals Corporation of America initiated a unique contribution to the titanium melting art by adapting the laboratory procedure of "consumable arc" melting to large scale mill production. By the consumable-arc technique the metal to be melted becomes the electrode of its own arc furnace.

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Let's set the record straight!

PRECISION CASTINGS ARE NOT LIMITED TO LONG RUNS

A lot of designers have the idea that precision castings must involve expensive tooling. It just isn't so. Hale Foundry Co. engineers have shown dozens of companies how nonferrous plaster mold castings offer finest precision at tooling costs not much higher than those for sand casting. For *limited production* parts —or for *pilot runs* on components that will eventually be die cast—Hale plaster mold castings answer your needs.

HERE'S A CASE-STUDY TO PROVE IT:

COMPANY: Universal Drafting Machine Co., Cleveland

PART: Aluminum chuck arm

Production run is die cast; but reverse part is needed for relatively few left-handed customers. Small quantity indicates precision plaster mold castings by Hale.

There is an equation with which you can determine the exact quantity level at which a part can most economically be cast in plaster molds. We'll be happy to show this equation to you. Just ask us.

For precision in limited production and pilot-run parts, call on

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Spincraft

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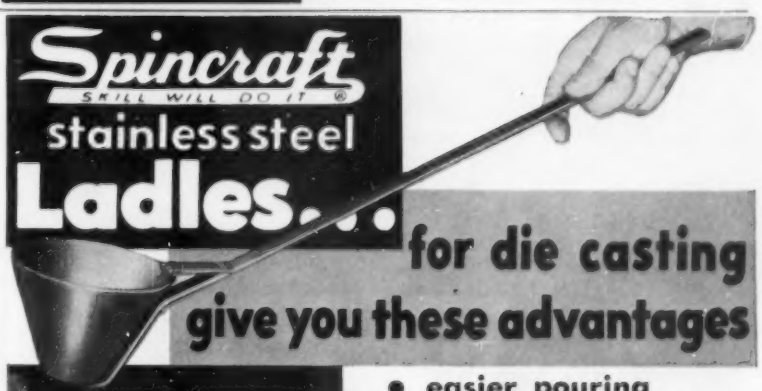
stainless steel Ladles... for die casting give you these advantages



- easier pouring
- increased output
- longer service life
- increased safety

Because Spincraft ladles of stainless steel are so much lighter in weight, because they are so resistant to high temperatures, because they so positively lower costs in all directions, they are now in use in over 200 die casting plants everywhere—including the country's leading producers. Write today for an informative bulletin illustrating Spincraft's wide range of ladle sizes.

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Established 1909

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REFERENCE DATA
continued from page 16

tion bulletins available from Litemetal Dicast, Inc.

47. ALLOY METAL POWDERS — prepared by the hydride process are described in Bulletin 800-B from Metal Hydrides, Inc.
50. FIRE RESISTANT — hydraulic fluid, Pydraul F-9, is the subject of a data book from Monsanto Chemical Co.
52. MOVING HOT CASTINGS — by special conveyor belt system designed to withstand hot, heavy or abrasive work loads, is explained in Bulletin MF-530 from May-Fran Engineering.
53. UNDIVIDED RESPONSIBILITY — for production of finished die castings and permanent mold castings is the special service described in Monarch Aluminum's Fact File on U. P. F. (Unified Production Formula).
54. STANDARD BEARING — catalog that saves money for designers and buyers, is offered by National Molded Products Co.
55. DESIGN GUIDEBOOK — on how to design parts that are to be produced from brass powders has been offered by New Jersey Zinc Co. The 32-page handbook contains valuable reference data.
60. BUYERS OF DIE CASTINGS — will find helpful information in a new brochure on die casting from Precision Castings Co., Inc. Plant facilities are introduced.
61. ELECTRICAL CONTROL — of every movement of the die casting cycle is a unique feature of cold chamber die casting machines covered in new literature from Peco Machinery Sales, Ltd.
63. A DIE CASTER who is offering a brochure showing his plant and facilities for the production of quality zinc and aluminum die castings is Racine Die Casting Co.
68. WAX MELTING — equipment and practice are presented in literature from Sta-Warm.
69. STAINLESS LADLES — that are lighter in weight and last longer

Continued on page 92

continued from page 54

For the cam, investment casting has been the only economical method of production found so far. Functionally, the cam, driving a gear train, meshes with a spur gear having its axis 90° to the axis of the cam shaft, and must advance the gear one tooth per half revolution of the cam. During the other half revolution, the train must be held motionless.

This piece is also cast by Arwood, in beryllium copper, and requires only hardening to 40 Rockwell C and machining of its shaft to ± 0.0005. As in the previous case, this required accuracy cannot be controlled in the casting.

The sewing hook is another part in which design was dictated by function. While such a part can be made by older fabricating processes, investment casting eliminates complicated form cutting, the large amount of accurate hand-filing, and much of the final polishing needed to correctly blend contours.

As in the previous examples, resistance to wear and lack of brittleness are important. The hook is, therefore, cast in SAE 1020 steel by the Austenal Laboratories. After casting, the shank diameter is finished to ± 0.001, the part is then carburized and case hardened to 60 Rockwell C and polished all over.

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REFERENCE DATA
continued from page 90

are offered for use for die casting and other casting processes by Spincraft, who have a bulletin listing sizes and specifications.

70. WHEN AND HOW — to use plaster mold castings are indicated in an illustrated brochure issued by Universal Castings Corp. Alloys and design information are included.

72. COMPOSITION, HEAT — treatment and use of two die casting die steels, Hotform and Speed-Cut, are important features in literature available from Vanadium Alloys Steel Co.

73. DON'T CUT PARTS, — cut costs, is the title of an informative brochure on powder metallurgy issued by Yale & Towne's Powdered Metal Products Div.

74. NEW BRIGHT FINISH — on zinc die castings without plating is covered in literature from Allied Research on their Iridite (Cast-Zinc-Brite).

75. DRILLING & TAPPING — two or more holes in a piece economically, by means of the Bellows-Locke drill unit, is completely described in a new booklet from Bellows Co.

76. SANDING CASTINGS — with an open-mesh abrasive cloth that does not load or clog readily is the subject of a holder from Carborundum.

77. CHROMATE CONVERSION — coatings that protect and enhance the appearance of zinc die castings are described in data sheets from The Chemical Corp.

78. SIX TYPES — of thread cutting and tapping screws, as well as drive screws, for fastening every type of die cast assembly, are presented in data sheets from Central Screw.

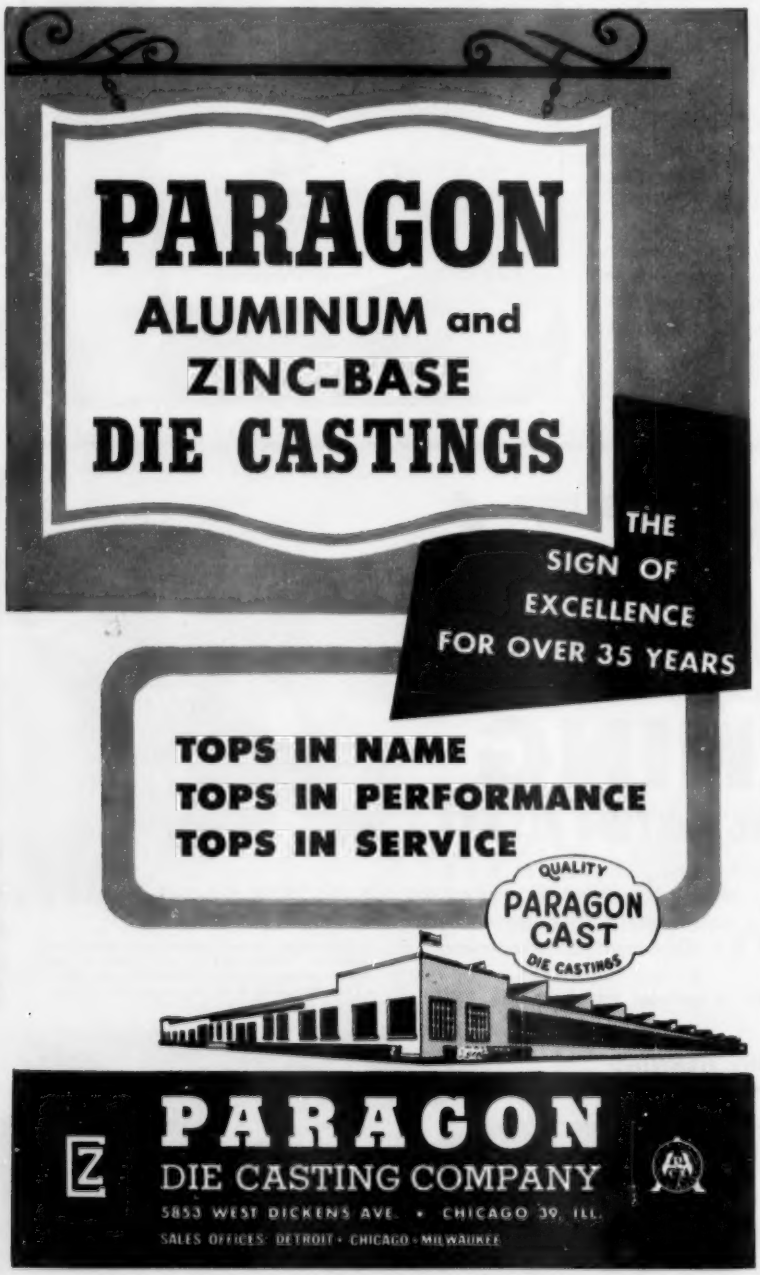
80. PLATING SPECIALISTS — who has a brochure to show its large plant for job plating of die castings, are the Four Plating Company.

81. BARREL FINISHING — catalog from Grav-i-Flo includes complete equipment, accessories and supplies for barrel tumbling of die castings and other metal parts.

82. HOW TO DRY — metal parts rapidly — as fast as 50 lbs in 35 seconds — by spin-drying them, is the subject of a brochure from New Holland.

83. METAL CLEANING — is thoroughly discussed in a 44-page booklet from Oakite entitled, Some Good Things to Know About Metal Cleaning.

85. FREE SAMPLES — of processed limestone and granite chips for barrel tumbling are offered for comparison by Universal Tumbling Supply Co.



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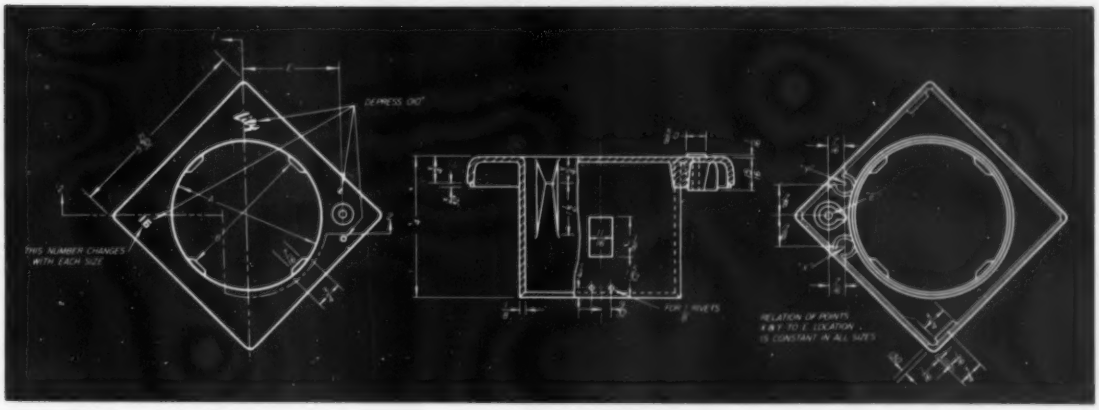

Factors That Affect Choice Of The Proper Casting Method

BY CLARK SIMS,
Equipment Manager
Lily-Tulip Cup Corp.

*When this article was written, the problem of a casting method had not been determined. Since then, the piece has been put into production. To find out what this company decided, turn to page 98.

ALL too many designers, when faced with the problem of a new product or the redesign of an older one, are prone to assume manufacturing cost as the principle consideration. Important as this may be, there are often other factors which, when weighed properly, may overshadow costs as the item of major importance.

Reduced to its simplest expression, almost any design problem resolves itself into . . . how shall a product be made to achieve acceptance? An acceptable end product, designated by the letter "G", can be shown as the sum of five distinct factors. Expressed as formula this is:

$$G = Q_1\ Q_2\ S\ T\ H$$

where Q_1 represents quality
Q_2 represents quantity
S represents space
T represents time
H represents the human element

How these factors all enter into the design problem and how they influence the method of manufacture will be shown by considering the throat for an elevator type soda cup dispenser.

The starting point in any design problem is to determine the functional characteristics of the part and to prepare sketches of a piece which, without consideration of any other factors, will do the intended job; Figure 1 is such a sketch. The problem of how to make the part and what material to make it from can now be considered on the basis of the drawing by substituting the properly evaluated factors into the original formula.

QUALITY "Q_1"

The first consideration here must be from a sanitary point of view. Since the dispenser is to furnish cups for food and since the rim of the cup must contact the wedges on the inside of the throat; the material of construction has to be one that can be kept clean. The surfaces must be smooth and the surface

Continued next page

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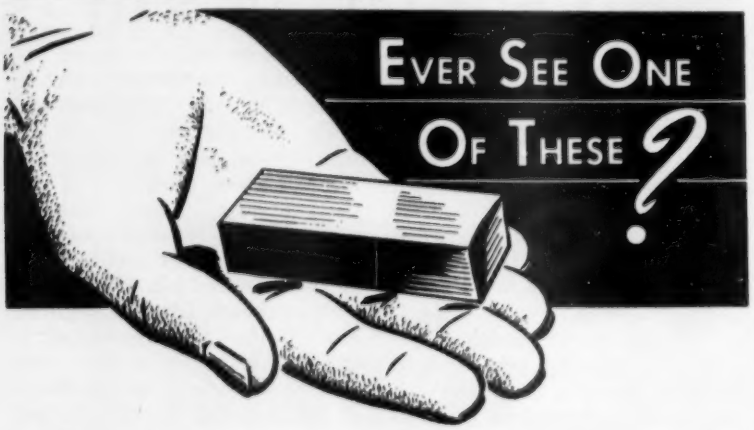

It's a Certified Stainless Steel Melting BILL-ETTE for precision casting. No more costly, time-consuming cutting up of larger units: you choose from over 30 different alloys produced to exact product specifications . . . . in the standard 1" x 1" x 3" or other sizes. Length can be ordered as required, at no extra cost.

BILL-ETTES bring a new convenience to precision investment casting. Certificate of Analysis and Heat Number with each shipment. Packed in 100 lb. kegs for ease of handling. Further metallurgical assistance yours on request. For specifications and prices on Certified Alloy Melting BILL-ETTES write to Metallurgical Division—

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finish should not show finger prints. These requirements will allow the use then of either a metal or a plastic and if metal, a casting with a flaw-free surface. While formed sheet metal can be used, as far as shape and function are concerned, the necessary joints would not meet the cleaning requirements since they could harbor dirt and bacteria.

Next consider the type of abuse that the unit may have to stand. Because the dispenser will be at a busy soda fountain where there is always a good deal of "banging around" the throat has to stand quite a bit of impact. This one factor alone rules out any of the economically possible plastics. There is left then only a metal casting.

QUANTITY "Q_2"

Under this factor must be considered not only how many units will be used, but also who will use them. Take the second item first — who will use them — mostly women and girls. For this reason the entire dispenser must be as light weight as possible so that iron, brass, bronze, stainless steel, and probably zinc are ruled out. There are left then, only aluminum and magnesium as materials of construction. Because of unfamiliarity with proper machining and finishing methods magnesium, in this case, was rejected and the throat resolves itself into some sort of an aluminum casting.

To evaluate the different methods of casting, some estimate of quantities must be made. In this case an initial production of 30,000 units will be used and the average annual production after that will be under 10,000 units.

Sand Casting — Based upon the cost of castings delivered from the foundry, a sand casting would be one of the lowest cost. Initial tooling is very low as is tool maintenance. However, both dimensional accuracy and surface finish are poor so that the rough casting would have to be

can, therefore, be considered as possible.

Die Casting—With every advantage in its favor die casting would be the best method of producing this part if it were not for the high initial tooling cost. machined all over. The prevalence of sub-surface imperfections which would spoil the appearance and make cleaning difficult might result in a high percentage of rejects. Casting, in green sand molds, is probably not an economical method of production.

Shell Mold Casting — For the number of pieces required, it is probable that a casting made by shell molding would be about the same cost or possibly a little less than a casting made in a green sand mold. Initial tooling would be slightly higher and tool maintenance about the same. The superior surface finish and accuracy of the castings would make finish machining and surface finishing far less costly and many operations needed on a sand casting would be eliminated. Rejects due to surface imperfections would be lower. This method of production, then, is feasible.

Plaster Mold Casting—Plaster mold casting would produce as good and possibly a better surface finish than a shell molded casting. Dimensional accuracy would be about the same and the number of rejects due to imperfections would be comparable.

Permanent Mold Casting — Comparable to shell molding or plaster molding as far as surface, accuracy, and probable number of rejects is concerned; permanent mold casting is a highly probable method of manufacture. The initial tooling costs would be somewhat higher, but other factors such as secondary machining and surface finishing might compensate. This method

Continued next page

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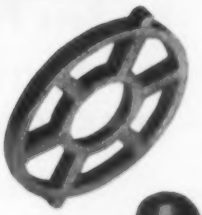
What Properties Do You Want In Your Iron Powder Parts?

STRENGTH . . .

. . . is the prime requisite for this meat-chopper cutting ring. Compacted from HVA electrolytic iron powder, its properties are: tensile strength — 57,000 psi; yield strength — 46,000 psi; elongation — 15%.



DUCTILITY

. . . is clearly demonstrated by a full 360° cold twist applied to this sewing machine connecting bar. It's a compact of HVA electrolytic iron powder with these properties: tensile strength — 40,000 psi; yield strength — 29,000 psi; elongation — 32%.

You'll get these—and more—with HVA electrolytic iron powder

These are only two examples of the broad range of applications for HVA electrolytic iron powder parts available to designers and buyers. It will pay you to investigate all the ways they can improve your present products, inspire future ones.

For facts on how HVA electrolytic iron powder can improve your product, write to

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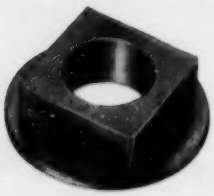

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Write today for detailed information and free literature on cost-saving standard bearings which are available from stock.

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How To Choose
A Casting Method — cont.

Accuracy, surface finish, low rejects, etc., are all the lowest for this method of casting.

This brief evaluation of the various methods of casting would seem to favor one of three processes; die casting, permanent mold casting or shell mold casting. Secondary machining costs, surface finishing costs and amortization of tools will be the points which will decide which method will be used.

Whether or not the part can be made by all three of these processes can only be determined by the fabricator since the skill of the individual foundry will enter largely into this factor. It could well be that some design requirement such as thin wall sections could eliminate one or more of the methods regardless of any other considerations.

SPACE "S"

The amount of physical space that will be taken up by the cup dispenser is an important design consideration. Since many fountains will use several units the outside should be made square so that the closest possible stacking can be accomplished when they are set vertically. In those cases where the units are set horizontally it is desirable that the top surfaces present a fairly smooth flat area that is useable as a counter or shelf. This requirement eliminates large flanges and cuts down, very materially, on wall thicknesses. Hence the space factor will help in determining the method of manufacture.

TIME "T"

How long will it take to get into production and how rapidly can deliveries be made. These two factors can have a very great influence on the choice of methods.

Of the three possible casting methods selected, shell molding can probably be in production the fastest followed by permanent mold casting and die casting in that order. However, rates of production may be important and here die casting is

by far the fastest with the other two methods about equal, permanent mold casting may be a little faster depending upon the individual foundry.

Delivery is not the only factor, however. How much finish machining and what type will have to be considered as will surface finishing operations. This latter point can stand some amplification.

Earlier it was pointed out that the surface of the finished cap must be easily cleaned and must not show finger prints. This latter factor at once eliminates a polished or plated finish. Painting is undesirable since it is not durable enough nor is anodizing. The most satisfactory finish found thus far is hammered or shot peened. Such a surface is easily cleaned and does not show finger prints. It is, further, easily applied and has the added advantage of not requiring as good surface preparation as plating. In all probability the as-cast surface of a shell mold or permanent mold casting is adequate for such a finish.

HUMAN ELEMENT "H"

This is, perhaps, the most difficult factor to evaluate. Consideration must be given to the person who will use the equipment and also to the customer who looks at it.

Experience has shown that the average soda fountain worker will not be particularly careful to avoid damage to the equipment. Nor will these employees take any extra pains about cleaning. A fast wipe with a damp cloth is about all that will be given most of the time, nor does the average employee care if his or her finger prints are visible to the customer.

From the customers' point of view, grooves that hold dirt and soil, finger prints, chipped paint, and a wide variety of other "little" things can lose business for the fountain as being indicative of poor housekeeping.

Thus the human element may bring into play some factors which can well eliminate the most economical method of manufacture in favor of a more costly one simply because from the customer point of view the "view" is not pleasant.

Which of the three methods of making this aluminum casting will be used? For this part, at least, the final decision will have to be made after consultation with foundries skilled in the various processes.

Editor's Note: To find out how this part is actually being produced, turn to page 98.

POWDER METALLURGY GROUP ORGANIZED ON COAST

Fabricators of parts from metal powders on the West Coast have recently organized an association to be known as the West Coast Powdered Metal Parts Fabricators.

At the initial organization meeting eight companies were represented and elected as charter members. R. H. Khuen is chairman of this group.

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NEW PRODUCTS
continued from page 75

compose at elevated temperatures, makes them useful as release agents for metals, plastics and rubber. In addition, these materials afford reduced maintenance, longer mold life and reduced part rejection.

Typical suggested applications are: release of the resin-sand molds from metal patterns in the shell molding process; masking during resin-dip applications, etc.

General Electric Co.
For more information, circle No. 206 on the Reader Service Card

DIAMOND LAPS
. . . diamond grit in bronze

A manufacturer of sintered metal bearings and parts has announced additional facilities for lap making now that the supply of diamond powders is assured. Matrix material offered is bronze with a wide variety of alloys — mesh sizes of diamonds from 80 to 500.

The company is said to be particularly well set up to make very small shapes and non-standard sizes. Experience covers many thousands of laps over a period of 15 years serving customers of long standing.

Immediate delivery can be made on all sizes where tools exist and two weeks delivery when tools must be made.

Wakefield Bearing Corp.
For more information, circle No. 199 on the Reader Service Card

TUNGSTEN HARD-SURFACING
. . . applied with paint brush

An entirely new kind of "metal-cladding" which can be applied to any surface by anyone at room temperature, which not only imparts to the chosen substrata a hardness and abrasion-resistance almost equal to metallic tungsten, but is self lubricating as well, has been announced.

Metallic tungsten of near colloidal particle size is suspended

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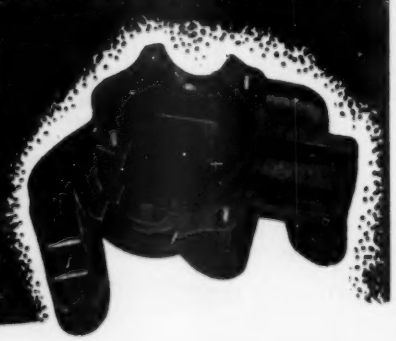
If you are located west of the Mississippi River we are in an excellent position to take care of your die casting requirements. Quotations made promptly.



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Circle No. 71 on Reader Service Card

Here Is The Method They Selected

Between the time when the article beginning on page 93 was written and publication, the decision was reached to use a shell mold aluminum casting.

This decision was based upon two factors.

1. The number of units probably involved.
2. The amount of machining that would be required to finish the casting for each different process.

The actual program to be followed is to produce about 95 castings in green sand molds using wood patterns. All of the "bugs" will be worked out, both from an engineering and production study and from a user study. Then, shell molding will be started by the General Aluminum Mfg. Co.

in a new type of extremely hard liquid plastic, and incorporated in the mixture is a hardening form of "Liqui-moly," providing a dry, clean built-in lubrication, with anti-sieze and anti-scoring properties of molybdenum disulfide.

The new coating is now being tested in such applications where a "case hardening" effect is desired on brass, plastics, and other soft materials and metals.

The Lockrey Co.
For more information, circle No. 201 on the Reader Service Card

ULTRASONIC METAL CLEANER . . . to remove dirt and soil

A new type ultrasonic cleaner which saves up to 90 percent of costs for solvents and more than half the direct labor cost for existing methods of industrial cleaning has gone into production.

The new unit operates with either water-soluble detergents or cleaning solutions and features the low-frequency, magnetostrictive transducer — achieving high penetration of ultrasonic energy.

The new machine operates by transmitting ultrasonic waves through inexpensive detergents or other cleaning solutions which surround the parts to be cleaned. The ultrasonic energy forces the solution to cavitate, or "cold boil", with countless minute bubbles. These bubbles implode and literally blast particles of grease, grit and other foreign matter loose.

Pioneer Central Div.
Bendix Aviation Corp.
For more information, circle No. 203 on the Reader Service Card

POLISHING-BUFFING LATHE . . . features extra wide swing

Special model RRO wide swing polishing and buffing lathe has been announced.

The lathe is a two-spindle machine, each spindle having its own motor, motor control and V-belt drive — allowing each operator to change wheels without interfering with or causing down time for the other. Each spindle runs in three ball bearings, one in the end of the spindle which is a part of the special outboard bearing assembly.

The heavy duty construction and rigidity of the outboard bearing permits the use of wheels up to 16-inch face on each spindle.

This lathe is especially suited for polishing and buffing of large and irregular shaped parts either by hand polishing or in conjunction with semi-automatics.

Hammond Machinery Builders, Inc.
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Established 1921

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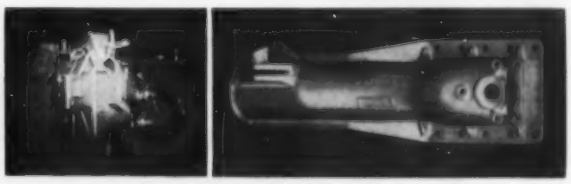

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1054 Front Ave. • Grand Rapids, Michigan

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DIE DESIGN SKILL
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while keyed to the main core, will remain in position in the casting when the main core is withdrawn. This separate piece is later moved laterally by hand to remove it.

Before the die is again closed, the loose core is put in place and held there. Only because of such construction of the die is it possible to make this part.

These are only a few of the problems that the die designer faced with this casting. Quite obviously, if die casting was to be used most economically, substantially all of the machine work on the casting had to be eliminated. As the part finally crystallized, only a few holes had to be drilled and some cored holes tapped; this very simple machining replaces 18 separate operations that were necessary when the shroud was made as an assembly of stampings, sand castings and machined parts.

On the head casting, Figure 5, a required design feature was that the portion of the head above the lateral slot be recessed so that the wringer pressure release bar could be set flush and yet be positive in operation when pressed without the necessity of precise aim. The design of the head that evolved from this requirement is shown. It is quite obvious that no method other than casting can produce this part, as a single piece, and quite probably only die casting could produce it economically.

7. ECONOMY and appearance are two reasons for die casting this group of small parts for the wringer assembly.

This head casting is also a large die casting, although not as large as the shroud. Nevertheless, metal flow is a problem and in this case warpage of the long thin sections, which cannot be ribbed for stiffening, can be a major headache.

The required offset mentioned above was solved by the die designer by the use of interlocking die members so that only a thin web of metal would exist across the slot. This web is easily removed by punch press.

The trimmed casting is substantially complete: only the hole in the center top must be reamed to secure precise sizing and several cored holes (see the reverse view) must be tapped.

Die casting in this case has reduced the number of operations from eight to two.

Some other die castings are used on this wringer housing, these are shown in Figure 7. All of these castings are produced as zinc die castings for reasons of economy.

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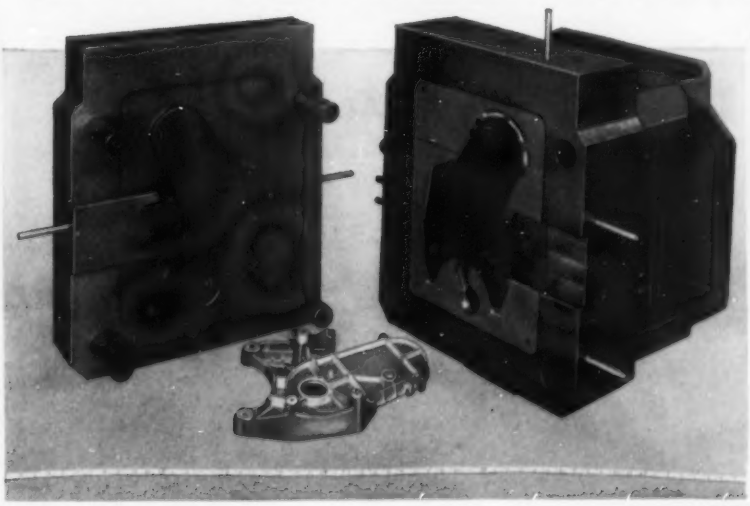

A mere glance will show that adequate equipment was required to make the die pictured above. Also, into its design and construction went a know-how growing out of a 21-year background. Cuyahoga places at your command a complete engineering service in die design.

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MANUFACTURERS OF WEDGELOCK DIE CASTING MACHINES

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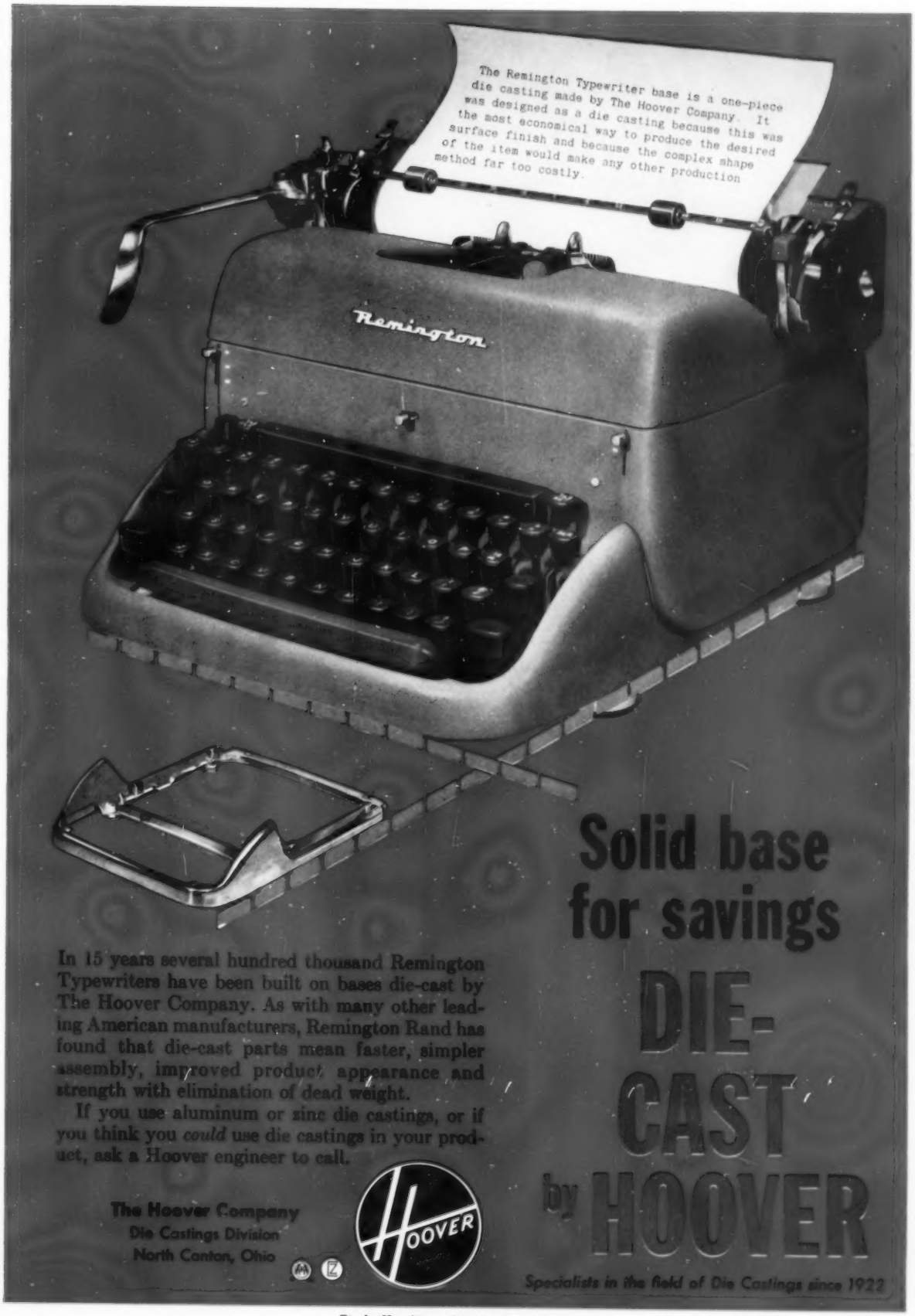
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